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Soil Drift Control in the Mallee

EIGHTH ANNUAL COMPETITION

By R. G. Thomas M.Agr.Sc. Senior Conservation Officer, Soil Conservation Board

A well-filled dam is a priceless asset in the Mallee.

THIRTY-THREE landholders with farms totalling over 60,000 acres, competed in the Eighth Annual Mallee Soil Drift Control Competition. Judging took place during the early part of March, a period of the year when, under the dry autumn conditions usually experienced in the Mallee, faults in farm management frequently show up. For that reason, early autumn is the best time to judge the efficacy of soil drift control measures.

The 1947 season had been generally favorable from the point of view of vegetative growth. Following exceptional late summer and early autumn rains, a dry spell occurred during late autumn and early winter. This interfered with normal seeding operations; in general, crops were either sown very early, while the ground was still moist from the summer and autumn storms, or else seeding was delayed until after winter rains had fallen in late June. Subsequently, rainfall was more than adequate for growth, so that both crops and herbage made good growth.

Unfortunately, much of the late winter and October rain was received as showers, creating humid conditions favorable to the rapid spread of the wheat disease "rust", which took toll of the grain yield of Mallee crops. While this occurred generally throughout the Mallee, the visitation was most severe in the Millewa country, where it was least expected. Many crops in that region were rendered valueless for grain, and the trouble frequently was not recognized early enough to allow of some use being made of the crop by cutting portion for hay. Many Millewa farmers, anticipating from the excellent crop growth, a grain yield possibly beyond anything obtained since settlement, suffered acute disappointment.

The matter is important from the soil drift control angle in that farmers might, and do, quite rationally ask whether the practice of retaining instead of burning the wheat crop stubble, which has steadily gained favour of recent years, has not contributed to the severity of this outbreak of a disease which had not been greatly in evidence for many years previously. The truth of the matter is that such practices can have little or no influence on the occurrence or non-occurrence of rust.

The disease is caused by a fungus which is a parasite on wheat and which is, unfortunately, always present in our wheat crops. Usually, climatic conditions in Victoria are such that the disease does not flourish, and, consequently, is not noticed or is considered of little account. The disease is spread by means of air-borne spores or seeds which are produced rapidly and in great numbers under suitable conditions of moisture and mild temperatures. The spread of the disease, which is rapid under such conditions, continues as long as the climatic conditions remain favorable and host plants remain to be attacked.

Rust spores do not infect, nor does the fungus itself grow within the dead wheat stubble—only a live "host" can be attacked. The spores can live for only a limited time and must find this live "host" within a comparatively short time or perish.

Last year's summer and autumn storms provided ample host plants by way of self-sown wheat and barley, and grasses. The presence of these plants enabled spores to be carried over the winter in greater numbers than usual, and thus there were large numbers of spores in the air in the early spring. The showery conditions of the early spring and October provided conditions which permitted this increased spore population to multiply and spread rapidly, with the above mentioned results on grain yields.

It can be stated definitely that any decrease in the number of rust "spores" that might occur as a result of stubble burning in the autumn is of little importance. There are always sufficient rust spores remaining to spread the disease once conditions become favorable for its rapid growth.

THE IMPORTANCE OF COVER

What is also certain is that the lack of soil protection which results from stubble burning has an effect on the ability of the soil to remain in place and to produce healthy, disease-resistant crops.

Serious rust infection is unusual; the danger of wind erosion is ever-present. It is poor business then, to give up an efficient erosion-control practice in order to secure a very doubtful advantage in rust control. Observation by farmers and others interested indicates that the maintenance of cover is the first, and most efficient, defence against wind erosion.

In an area where the growing of cereal crops is the most important use to which the land is put, maintenance of cover includes the non-burning of stubble and/or trash, and the keeping of that stubble or trash on the soil surface during the period of preparation for a crop.

Sowing oats in wheat stubble, Hopetoun district.

While the value of stubble for erosion control is generally recognized, and few farmers now burn stubble or trash prior to fallowing, it was rather alarming to find numbers of paddocks burnt over this year to enable a crop of oats or barley to be sown. This was no doubt due to a desire to sow stubble crops in the best condition possible, on account of the probability of attractive prices for oats and barley.

Admitting the difficulties of handling the heavy body of straw developed by last year's crops and of sowing the seed in a satisfactory manner with the equipment at present available, nevertheless, the risks attaching to the practice of stubble burning must always be taken into account. Any advantage to the crop that can be conceived as likely to accrue from a more regular seed-bed, even depth of planting, &c., can easily be more than counter-balanced by one wind storm occurring any time from the stubble burning until the crop is several inches high.

Disc drill and tandem-disc harrow, used to sow oats in the wheat stubble, Woorinen.

The effect of storm damage, however, is not limited to the one crop; it will be reflected in difficulty in working and in crop yields for years. Farmers, therefore, are urged to make special efforts to handle their stubble-sowing without stubble-burning. The farmers' ingenuity can usually find a means of so doing, once the need is recognized. Various examples of this were seen during inspections; for example, seed broadcast or drilled out and then disced over, and old two-way disc-harrows used in tandem with the discs of one harrow reversed.

A good fallow, Rosebery district. Note its cloddy, ridged condition, and the old stubble showing through the surface.

TRACTORS AND HORSES

Twenty-one entrants used tractor power, ten used horses only, and two used both tractor and horses. It seems only a matter of time, and availability of tractors, before the number of teams used on Mallee farms is further reduced. Several farmers were waiting for tractors, and even that well-known horse enthusiast, Mr. V. L. Watson, now operates a tractor.

There has been a tendency of late to stress the erosion hazard associated with cultivation by rapidly moving tractor-drawn implements, particularly disc implements. This hazard does exist. There are, on the other hand, definite advantages in tractor operation in regard to ability to handle maximum areas while the ground is in suitable condition, and also in lack of harmful effect on fences and constant stock traffic about the homestead.

The advantages are definitely with the tractor, and the objections to its use are not inherent in the tractor—it is for the operator, the farmer himself, to determine what implement shall be used and the speed at which it shall be operated.

The tractor is not to blame. Usually such troubles are caused by the tractor-owner undertaking a programme of work beyond the capacity of his plant to carry out as it should be carried out. There is need for restraint and careful thought on this matter, especially by new tractor owners, anxious to undertake more work to pay for an expensive tractor and not yet experienced as to just what can be properly

handled by that tractor. The emphasis must always be on the words "properly handled"; if this aspect is kept in mind, few mistakes will be made.

COVER CROPS

Cover crops are used by all entrants in the Walpeup Shire; by all but one entrant in the Mildura Shire, and by several competitors in the Dimboola-Karkarooc and Kerang-Wycheproof regions.

Rye is generally used on the marked sandy ridges, while oats is more commonly used for larger sowings on generally "drifty" country. When the cover crop was first introduced, it was usual to sow it some time after fallowing, the "combine" being used for this purpose. Since then, some farmers have found that they could not rely on obtaining favorable sowing conditions so late in the year, and have at times been unable to sow the cover crop, or have had unsatisfactory results. As a consequence, they have tried sowing the cover crop either at, or immediately after, fallowing. Several such "cover crops" of oats were seen. They showed much more growth than is usually looked for in a cover crop, but they certainly provided soil protection.

The question arises as to the effect of this considerable growth on the yield of the subsequent wheat crop, and this question can only be satisfactorily answered by experience. However, it would seem that, since intensive working or stocking of any country that requires cover-cropping is prohibited by the very nature of the country, weeds are likely to make a considerable demand on soil moisture and plant foods, if a cover crop does not.

This year most fallow, and ridges in particular, carried considerable weed growth, except where a cover crop existed. As the fallow-time cover crop affords better soil protection, and offers also some return from grazing or grain, it would seem that the balance is likely to be in favour of the early-sown cover crop.

COMPETITION AWARDS

Hanslow Cup Winner

The entry of the late Mr. H. J. Mudge, of Karawinna, secured first award. It is indeed pleasing to see the principal award going to an entry from the Mildura Shire, which is, of course, the region where the erosion hazard is greatest. This farm of 1,460 acres, with its alternating flats and ridges, is typical of the district and carries a fairly high erosion risk. Its condition reflected great credit on Mr. Mudge and on his efforts, over the years, to prevent wind erosion.

The farm is well sub-divided, with an adequate belt of 50 acres of uncleared land around the homestead, uncleared land around dams, and water pumped from the main dam for household use. One paddock has not been cleared. The home and dams are thus well protected, and, in all but two paddocks, stock have access to good shade and shelter. Unfortunately, although the property formerly carried sheep, wild dogs became so troublesome last year that Mr. Mudge was compelled to sell his sheep. This, perhaps, had a favorable influence on the condition of the property at the time of inspection. Liability to erosion "patches" would be reduced; on the other hand, weed control would be more difficult, but, in this respect, the property compared very well with other district entries.

The farm was tractor operated, and Mr. Mudge favoured a four-course rotation of fallow, wheat, oats or wheat, and pasture. He stressed, however, that, on account of seasonal irregularities, a hard and fast rotation had not been adhered to; following crop failure in the recent drought years, wheat was again sown on the "crop-failed" land.

Stubble was not normally burnt, although last year a light fire-harrowing was given after stubble had been disced in, to enable the "combine" to be used for sowing.

Fallowing was usually done with the disc, in order to handle stubble and trash remaining on the ground, and has been carried out any time between July and September, according to conditions. It was usual practice to fallow the flats early and to scarify, disc, or spring-tooth cultivate the flats as weed growth demanded.

The ridges have been either fallowed late and not worked prior to autumn, or fallowed earlier and cover-cropped with oats if conditions were favorable.

May sowing of wheat was preferred, although last year sowing was delayed until late June. The varieties Quadrat and Bencubbin were favoured.

Dense tree shelter gives wind protection to this Mallee homestead from all quarters of the compass.

A point that this competitor particularly emphasized was that any bare patches occurring in ley land were worked up and sown, usually with oats, to provide cover. In this is exemplified that care for the land which is essential to the well-being of any farm. That care ensures that anything necessary for the continued well-being of the land, be it a large or small matter, will be undertaken as soon as the need arises. Prompt treatment of the small bare patch means that the large bare patch, and the subsequent poor patch of crop, do not occur.

Second Prize

Second place was awarded to Mr. V. L. Watson, of Nyah West. This competitor's farm has been prominent in competitions in former years. The property of 2,370 acres is in a very stable condition, which reflects the soundness of the management; but adjacent land and close examination of signs of former drifting on the property itself, tell of the liability of the soil to drift.

Mr. Watson states that there are no golden rules to follow in combining successful farming and erosion control. Holding the fallow is his greatest worry; yet he is definite that fallow is essential to successful wheat growing in that district.

The general rotation is fallow, wheat, oats or wheat, and then left out to grass for some years—there is no set period of "ley", but the land is cultivated and cropped when the cover begins to thin out.

Onion weed is present on the property, but is stated by the owner to be no detriment in the production of wheat.

Sheep numbers are kept low; on the other hand, breeding horses and young stock have been kept in numbers much beyond power requirements, and last year 30 head of cattle were carried for several months.

Fallowing with the mouldboard plough is preferred, unless there is sufficient stubble or trash to necessitate the use of the disc, as the former implement leaves the soil in a more cloddy condition.

Fallowing is often commenced as early as June, the heavier flats being ploughed first; the ridges are usually ploughed September–October, and are often left in the sod. Drifty areas ploughed earlier may be cover-cropped with rye.

Cultivation of the heavier flats varies with the season, but the state of the fallows inspected by the writer reflects the discriminating choice of implement to suit the conditions. An adequate plant includes scarifier, spring-tyne cultivator, "combine", and tandem-disc harrow.

Adequate water supplies are provided by five dams of from 1,500 to 4,000 cubic yards, and careful thought has been given to the retention of timber to protect the dams and provide shade and shelter for stock. Ornamental and protective planting

Crossbred ewes on Mr. G. M. White's farm, Torrita.

around and near the house, already something to be proud of, is being continued. Erosion control, comfortable living, and permanent farming go hand in hand.

Third Prize

Mr. G. M. White, Torrita, scored a notable success with his first entry in the competition, by gaining first place among the entrants from the Shire of Walpeup, and third place in the Hanslow Cup awards.

This indicates that there must be many other well-conducted farms in the Mallee, the owners of which have not yet entered in the competition, but whose experience, given publicity, would be of interest and benefit to fellow farmers.

Mr. White's property shows evidence of serious wind erosion in former years, but there is now every evidence of good management, not only in regard to soil management, but also in respect to the care and maintenance of buildings and efficient handling of stock.

In regard to erosion control, most known methods are used according to the demands of varying soil and climatic conditions. Recourse has been made to the use of single furrows under emergency conditions, but the guiding principle is the maintenance of cover.

Stubble has not been burned for some years; usually oats are sown on the wheat stubble with the Sunderseeder or disc drill. These may be fed off and/or stripped for grain according to seasonal and other conditions.

Treatment of paddocks and of parts of a paddock, is varied to suit the particular soil.

One paddock that had been known to drift badly under fallow is not fallowed at all now, but is sown every year—a programme that affords continuous cover and should prove satisfactory provided the crop is at times treated as pasture and not removed as hay or grain.

Last year, one stubble paddock was sown to wheat, with oats on the ridges. The oats were blown out in the autumn and the ridges were again sown, this time to cereal rye. The paddock was grazed till August, and Mr. White reported that the sheep had concentrated on the Algeribee oats in preference to Bencubbin wheat.

This competitor is one of those who, for reasons before mentioned, sows a cover crop of oats when first preparing the fallow. For the past two seasons, 40 lb. of oats per acre were sown when fallowing with the "Sunderseeder" in July–August. Last year's growth had been fed off with discretion, and ample protective straw had been left. Possibly a lighter seeding would have given equally effective soil protection.

While the crop had no doubt taken some toll of plant food and moisture from the fallow it had resulted in an almost entire absence of summer weeds, which were generally troublesome on last year's fallows.

SHIRE AWARDS

Karkarooc and Dimboola Shires

The entry of Mr. A. E. Barbary, Woomelang, which gained first place in a number of creditable entires in the Karkarooc-

Rubber tyres on scarifier give light draught and allow an early start to be made after rain.

Dimboola district, again impressed with the condition to which fallow land is prepared with a minimum number of workings. The mouldboard plough is preferred for the first working unless the amount of rubbish necessitates the use of the disc, and the scarifier or the "combine" is used for later workings.

All workings are done with the ground as wet as possible. A good range of implements is available, and Mr. Barbary makes a point of using the right implement, and using it as soon after rain as possible. Pneumatic tyres fitted to scarifier and disc cultivating plough make possible the use of these implements on fallowed land some time earlier than is the case when steel wheels are fitted. Tractor and implements alike are overhauled after a job is completed, so that they are ready for immediate and maximum service when needed. In a region where rainfall is light, and where the soil soon dries out, this is very important.

Attractive home surroundings on the farm make for contentment and stability.

No stubble has been burnt on this property for many years, and its present condition contrasts markedly with the signs of erosion of former years.

The usual rotation practised is fallow, wheat, oats or barley, and pasture for one or two years, with Wimmera rye grass used to increase grazing returns. However, Mr. Barbary states that, in the interests of erosion control, the rotation is not adhered to rigidly; if a paddock has not sufficient vegetation for grazing or for fallowing, it is sown to provide that cover.

Cover crops of oats or rye are used on "drifty" ridges when conditions are suitable and strips near roads and around dams are left unfallowed.

A notable feature of the property is the care that has been given to sub-division and provision of stock water in paddocks. "Take the water to the sheep and not the sheep to water" is a good erosion-control maxim carried out on this farm.

Mr. G. S. Staples, of Rainbow, again submitted an entry worthy of high praise, and was placed second in the Karkarooc-Dimboola area.

This farm of only 630 acres of undulating country definitely liable to drift, is maintained in a high standard of production and erosion control by methods entirely different to those of say, the farm previously quoted. An important point is here illustrated; soil conservation can be achieved by a variety of methods if the need for erosion prevention is recognized. Mr. Staples expresses it in this way—"I am opposed to soil erosion in my mind; this is the first line of defence".

Features on this farm worthy of special note are firstly, that the land is treated according to type and condition, and secondly, that emphasis is on stock rather than grain production to a greater extent than usual with Mallee land.

Light land is not usually fallowed nor sown to wheat; the boundaries of different workings and sowings follow approximately the changes in soil type and consequently give irregular-shaped blocks worked and sown differently within the one paddock.

Barley and oats are the crops grown on the lighter areas, with cereal rye sometimes sown on small areas particularly liable to drift.

The rotation has, of late years, been irregular because of seasonal variations, but usual practice is fallow, wheat, stubble grazed and disced up late, oats next autumn,

followed by a period to grass. Oats or barley without fallow take the place of wheat on light land, as explained previously.

Fallowing is not normally carried out until much later than is usual in the Mallee, Mr. Staples maintaining that the extra grazing obtained and reduced erosion hazard compensate for any loss in grain production that may result from the later fallowing.

A minimum of cultivation is necessary after the late fallow, which normally leaves the ground with a good "sod". Subsequent workings are mostly with the scarifier, and while the ground is moist. No stubble has been burnt for many years.

Third place in the Karkarooc-Dimboola area goes to Mr. S. C. Schack, of Gama, whose farm of 856 acres is in the north-east corner of the district, and carries a high degree of erosion hazard.

Considering the hazard existing, Mr. Schack has made creditable efforts to hold his soil. Stubble has not been burned for some ten years, and endeavour is made to maintain a cover. The usual rotation is fallow, wheat, oats or barley, and pasture, but grass-land may be sown to oats or barley to give stubble to work into the fallow. Fallowing is commenced soon after cropping and the mouldboard plough is preferred if it can handle the trash. The scarifier is favoured for later workings.

Cereal rye is used to hold the drifty ridges. After early autumn rain, rye and barley were sown on a bad ridge with very successful results. Sand from this ridge formerly filled a water channel. Ridges in a fallow paddock were sown with rye at the latter end of June; although adequate cover was obtained, early sowing of rye is favoured.

Other entries in this district were all worthy of favorable comment, but most of them have already been commented upon in earlier reports.

Mr. C. T. Robins, of Hopetoun, is a new entrant whose property showed points of interest.

Fodder conservation and supplementary feeding of stock are the outstanding features of this farm. Oats are sown regularly on the wheat stubbles and oaten hay is cut and stacked whenever possible, while oaten grain is harvested as occasion allows.

Hay is stacked in mouse-proof enclosures, and, during the recent drought years, all stock were carried through adequately on farm-grown feed and some hay still remained at the end of that time. Incidentally, stocking rate at one sheep to $2\frac{1}{2}$ acres is one of the highest in the competition.

Mr. Robins is fortunate in having an area of heavy "flats" adjacent to the Yarriambiack Creek, on which hand-feeding can be carried out with little danger of erosion. As a result of experience, this competitor now feeds hay and grain to his sheep on alternate days, and states that, by so doing, hay spread out (on firm clean ground) is utilized without waste. The rate of feeding is a sheaf (about 6 lb.) to four sheep and 1 lb. of grain per sheep. Grain is fed initially at a rate of about 3 oz. per head, working up to 1 lb. after seven days.

Mr. Robins showed one paddock of fallow on which a cover crop of rye had been sown on an area regarded as subject to drift, but was disappointed to find that another paddock, regarded as "safe", had commenced to drift because of the trafficking of sheep admitted to the paddock to handle paddy melons.

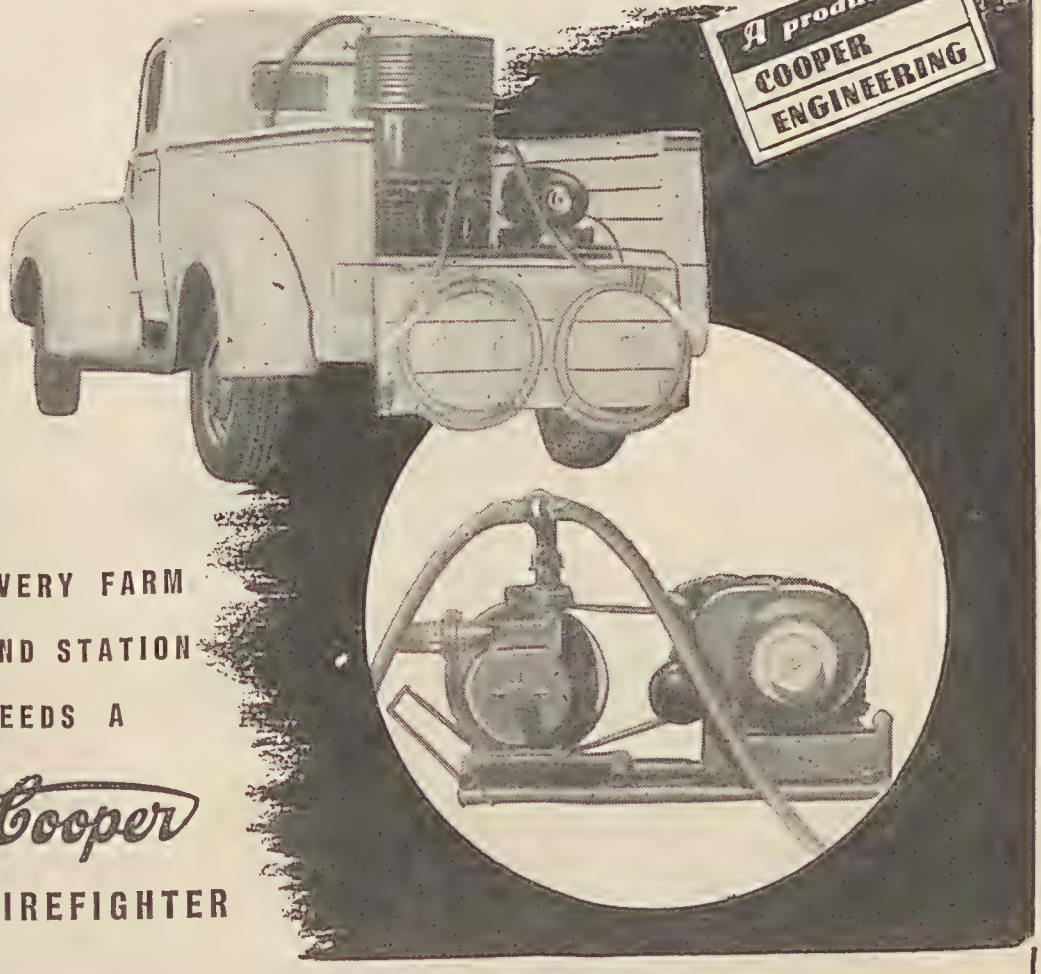
This serves to emphasize the fact that practically all Mallee land will drift when cultivated or otherwise bare, and that constant care must be exercised with all of it.

Portion of the hay reserves on property of Mr. C. T. Robins, Hopetoun. The open stack had been held for nine years.

Wycheproof and Kerang Shires

The condition of the fallow on the property of the winners in this section, Messrs. A., J. A. and C.P.

FIRE CONTROL



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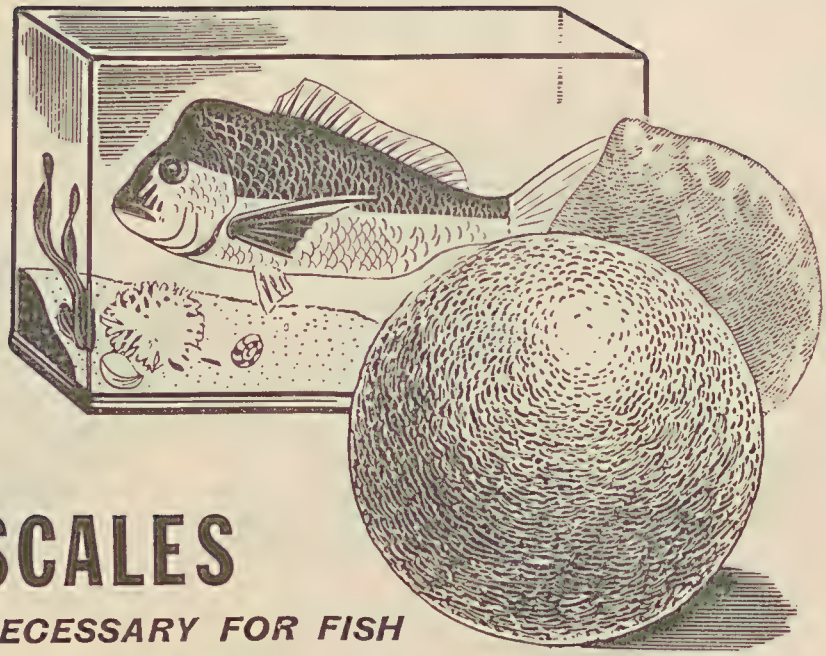

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Steele, Woomelang, reflected the excellent judgment with which their 3,800-acre property of varying soils has been handled.

All the cultivation work has been done with horses, two ten-horse teams being used. The land varies from fairly heavy flats showing some ironstone to light sandy ridges, and treatment of the various areas showed a nice appreciation by the operators of the maxim to "treat each acre according to its needs".

The long mound of soil was caught and held by crop and stubble within the boundary fence. The soil came from the paddock at right.

The usual rotation on this farm is fallow, wheat, oats, followed by pasture for a varying period, but once again it is emphasized by these farmers that a rotation cannot be rigidly adhered to. Grassland that is becoming bare is broken up and sown. Oats are relied on for hay and grain for feed, and some barley is grown on the lighter land.

The mouldboard plough is preferred for fallowing unless there is sufficient trash to necessitate the use of the disc, and fallowing commences in July.

Sandy areas, when fallowed, are cover-cropped at time of fallowing to rye, oats, or barley, the crop being fed off lightly when it begins to "stem up". This season Messrs. Steele had, in this manner, fallowed and cover-cropped a ridge very susceptible to drift and on which much drift had formerly occurred. In addition to the cover-crop, single furrows had been ploughed at intervals; the whole treatment was very effective, and, despite some severe "blows", little soil movement had occurred.

Other light areas which had an adequate grass cover had not been fallowed, but had been scarified after a February rain.

Attention to detail was seen in the ploughing of single furrows where stock traffic through gateways, &c., had created conditions favorable to drift.

The Steele family insists that it is only by awareness of erosion hazards, and by taking all possible preventive steps before the time of the bad "blows", that serious trouble can be averted. Most farmers realize that the small blown patch is the fore-runner of the big blown patch, but frequently neglect to take precautions to prevent the spread of the little patch.

Mr. A. W. Mesley's property of 1,400 acres at Mystic Park secured second place. Here also is a considerable variation in soils, the "flats" being of such nature that prong mouldboards are used for ploughing.

Subsequent cultivation is done only after sufficient rain has fallen; on the heavier land the harrows may be used in the autumn to break down clods and ensure a good germination of weeds prior to sowing.

Light areas are usually fallowed late, and may be sown to rye. Couch grass occurs on the ridges, but is thought to have not materially reduced crop yields.

Every endeavour is made on this property to maintain a sufficient vegetative cover for soil protection at all times. This requires good stock management. Mr. Mesley endeavours always to remove sheep from any paddock before the dry feed becomes too thin; also, fallowing is not carried out until the new growth has attained sufficient body. Oats are sown in the stubble with the disc drill.

Water supply in every paddock facilitates stock and land management.

The farm poultry are enclosed and, consequently, are unable to develop that bare, loose surface adjacent to the home, but outside the area protected from the wind, that so often acts as a focal point from which a "blown" area develops.

Mr. H. W. Miles, Mystic Park, is a new entrant in this region, whose farm and homestead alike reflect care and good management over the years.

Working an area of 857 acres, Mr. Miles uses a rotation of fallow, wheat, followed by oats or grass. He has not burnt stubble for three years. Last year, Sundercut and disc drill were used to sow oats on stubble, but, in future, it is proposed to use the tandem-disc harrows.

Mr. H. Gillies, Beauchamp, has exercised the proverbial ingenuity of the farmer in coupling two sets of old disc harrows, one behind another and with one set of discs reversed, to approximate the work of the modern tandem-disc harrow.

Swan Hill Shire

First award in the Swan Hill Shire competition went to Mr. V. L. Watson, who also secured second place in the Hanslow Cup competition, and on whose entry comment has already been made. Second place goes to the entry of Mr. W. A. J. Pearse operated by Mr. Murray Pearse.

This is a farm of 1,400 acres, operated by horses, on a rotation of fallow, wheat, oats, and then grass for several years.

Fallowing is done with the Sundercut in August, and this implement is often used to work the fallow on account of the prevalence of onion weed.

Cereal rye has been sown to good effect on light ridges, and stubble is not burned.

Considerable drift is indicated by quantity of sand held by fence. The property, Swan Hill district, is without sand dunes or bad ridges. Note how the wind, deflected by tree, has blown the moving soil farther on.

Couch grass is present on some of the light ridges, and is blamed for the drift mounds formed thereon; however, these are attributable rightly to faulty working of adjacent land in earlier years. The couch grass has merely caught the drift and has done more good than harm; in all matters relating to drift control we must be sure of cause and effect if our efforts at treatment are to be successful.

Mr. R. O. Hanson, farming 1,260 acres at Yarraby, is another competitor who still operates with horses, and who, nevertheless, was able to show creditable fallows. The rotation practised on this farm is fallow, wheat, and then out to grass for three or four years. Stubble land is sown only after a "dry" year. The Sundercut had been used for fallowing and for later cultivation on account of paddy melons and other weeds, and sufficient trash had been worked in to hold the fallows.

Walpeup Shire

First award went to Mr. G. M. White, third in the Hanslow Cup competition, and, therefore, needs no further comment.

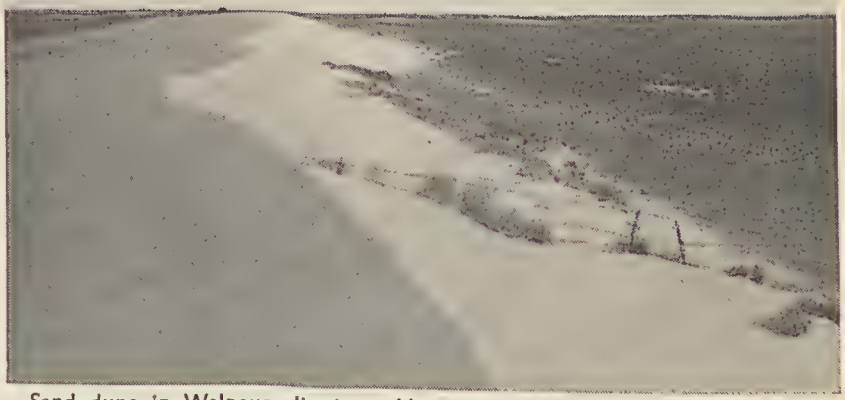
Mr. P. A. Hannig, of Walpeup, secured second place, with an entry which includes his farm of 728 acres, and two other blocks recently acquired on lease. These last-mentioned blocks have been neglected for some time, and considerable erosion and dune formation have occurred. The restoration and return to productive use of these blocks is being undertaken by Mr. Hannig, the immediate programme being one of re-clearing and cropping, with rye used on the drifted areas and dunes.

On his original holding, Mr. Hannig has not burned stubble for a number of years. Formerly, a three-course rotation of fallow, wheat, oats, was practised, but it is now considered that a longer period between fallows is necessary. Any places showing signs of drifting are worked up and sown, preferably with rye, although wheat or oats may be used.

Fallowing is commenced in July, and the light

hills are left till last. Sowing of stubble land has been successfully done by sowing seed on the stubble, and subsequently discing over.

Mr. Hannig uses horses and keeps cattle instead of sheep. He contends that his returns from cattle sold as young milkers and as vealers, compare favorably with those from sheep when the lesser labour and capital outlay required are taken into account. Also cattle do not create the erosion hazards that accompany sheep, and are more easily and safely hand-fed in times of scarcity.



Sand dune in Walpeup district. Note bare strip, right, from which soil has been blown. As a first measure in preventing extension of dune, the bare strip must be stabilized. This may be done by growing rye.

Messrs. S. and D. Pole, of Torrita, showed improvement in methods of control on rather difficult country. For cover-cropping light ridges the mouldboard plough with seeder attached was used to sow oats when fallowing on most of the ridges. Part combined to rye a little later was not nearly as successful as the earlier sowing.

Messrs. Pole are among those who think that the success in controlling drift and weeds plus returns from the early-sown cover crop, more than compensate for any loss in yield of the subsequent crop that may result from the early sowing of cover crops.

Mildura Shire

The Mildura Shire can take pride that the winner of this section, Mr. H. J. Mudge, of Karawinna, is also the winner of the Hanslow Cup.

Bearing in mind the more difficult conditions of the area, the standard of farming reached by the leading competitors compared favorably with that of competitors in the more favoured areas. This might be of some moral help to those who worked through difficult times to last season's promise and disappointment, and who are in some cases uncertain as to the basis of their future operations.

Mr. F. S. Callahan, Karawinna, was awarded 2nd place with an entry of considerable merit.

Stubble has not been burned on this property for some years. The rotation has of recent years been irregular, and sheep have not been carried for some years until recently, when crossbred ewes were acquired.

Usually wheat is grown after fallow every four or five years, and oats, barley, or rye may be sown on the stubble. Rye is sown on the tops of ridges. Fallowing and other cultivation is done only after rain, and heavy land is fallowed first, the sandy rises being left until the spring.

Effort is made to maintain cover on ley land, which may be sown if it is becoming bare, and to work as much trash as possible into the cultivated land.

The tandem disc-harrow or spring-tooth are used for working the fallow, according to the amount of trash to handle.

Thanks are tendered to all competitors and to those officers of the State Rivers and Water Supply Commission whose ready co-operation facilitated the work of judging.

SUMMARY OF AWARDS.

HANSLOW CUP

(1) The late H. J. Mudge, Karawinna.
(2) V. L. Watson, Nyah West.
(3) G. M. White, Torrita.

DISTRICT AWARDS.

KARKAROOC AND DIMBOOLA SHIRES.

(1) A. E. Barbary, Woomelang.
(2) G. S. Staples, Rainbow.
(3) S. Schack, Gama.

WYCHEPROOF AND KERANG SHIRES.

(1) A., J. A., and C. P. Steele.
(2) A. W. Mesley.

SWAN HILL SHIRE.

(1) V. L. Watson, Nyah West.
(2) W. A. J. Pearse, Nyah West.

WALPEUP SHIRE.

(1) G. M. White, Torrita.
(2) P. A. Hannig, Walpeup.

MILDURA SHIRE.

(1) The late H. J. Mudge.
(2) F. S. Callahan.

Agricultural Lime—Brands Registered for 1949

The list of brands of agricultural lime registered for 1949 is given below, and shows little change from last year, except for increases in prices following the general trend of increased costs of production and marketing.

The requirements of the *Agricultural Lime Act* 1934, both in regard to registration of a brand by the manufacturer and to the labelling of bags, closely follow those of the Fertilizers Act. Farmers should see that all bags of lime are properly labelled showing brand, analysis, manufacturer and weight.

For the purpose of the Act, agricultural lime can be in three forms—burnt lime (calcium oxide) slaked lime (calcium hydrate) or ground limestone (calcium carbonate). The relative merits of the three types, and general notes on the use of agricultural lime, are given in a pamphlet obtainable free of charge on application to the Chemist for Agriculture, State Laboratories, Melbourne, to whom general inquiries relating to agricultural lime should be addressed.

The need for agricultural lime has been established in certain parts of the State, but there are larger areas where lime does not give an economical return. If a farmer is not certain that he is in an area which will benefit from liming, he should either make inquiries or experiment on a small scale, before embarking on an extensive liming programme.

LIST OF AGRICULTURAL LIMES REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE AGRICULTURAL LIME ACT 1934 (No. 4271) FOR THE YEAR 1949.

General Description.	Brand.	Calcium Oxide.	In the Form of—	Equivalent to Calcium Carbonate.	Magnesium Oxide.	In the Form of—	Degree of Fineness. Material Passing Through a 20-mesh Sieve.	Price per Ton in 11-ton Lots.	Manufacturer.
		%		%	%		%	£ s. d.	
Ground Burnt Agricultural Lime	Lilydale, No. 1	87·70	Mainly oxide	156·90	5·00	Mainly oxide	65·00	4 8 8	David Mitchell Estate, Oliver's-lane, Melbourne, C.1
,, ,, ,,	,, No. 2	80·00	,,	143·00	5·00	,,	60·00	4 0 0	David Mitchell Estate, Oliver's-lane, Melbourne, C.1
,, ,, ,,	Kawa Oxide	83·00	,,	149·00	1·20	,,	90·00	4 11 0	P. Alkemade and Sons, 535 Little Lonsdale-street, Melbourne
Agricultural Slaked Lime	Lilydale ..	60·00	Hydroxide and carbonate	107·23	3·00	Mainly hydrate	72·00	2 8 7	David Mitchell Estate, Oliver's-lane, Melbourne, C.1
,, ,, ,,	Cave Hill ..	50·00	,,	89·50	5·00	,,	72·00	1 17 0	David Mitchell Estate, Oliver's-lane, Melbourne, C.1
,, ,, ,,	Bulldog ..	51·80		92·40	·80	,,	60·00	2 5 0	Bulldog Lime Co. Pty. Ltd., 344 Swan-street, Richmond, E.1
,, ,, ,,	Kawa ..	66·70	,,	119·00	1·20	,,	90·00	3 10 1	P. Alkemade and Sons, 535 Little Lonsdale-street, Melbourne
Ground Limestone	Lilydale ..	50·00	Carbonate	89·50	3·00	Carbonate	95·00	1 11 2	David Mitchell Estate, Oliver's-lane, Melbourne, C.1
,, ,, ,,	Lara ..	40·00	,,	72·00	1·00	,,	80·00	1 10 0	Lara Fertilizer and Lime Co., Lara Lake
,, ,, ,,	Kurdeez ..	50·40	,,	90·00	1·50	,,	80·00	1 8 0	Victorian Agricultural Lime Ltd., 422 Collins-street, Melbourne
,, ,, ,,	Kawa ..	51·40	,,	91·70	1·20	,,	75·00	2 10 6	P. Alkemade and Sons, 535 Little Lonsdale-street, Melbourne
,, ,,	Box Bank ..	42·00	,,	75·00	1·00	,,	79·00	1 5 0	Whiteacres Pty. Ltd., 397 Little Collins-street, Melbourne

Melbourne, 2nd December, 1948.

W. R. JEWELL, M.Sc.,
Chemist for Agriculture.

TURKEY RAISING IN VICTORIA

By M. D. Hall, Poultry Expert

American Bronze turkeys on free range.

The rearing of turkeys can be successfully carried out in the northern areas of Victoria with less trouble and expense than is generally supposed, and can be made a most profitable sideline.

In the Goulburn Valley, for instance, large quantities of wheat and lucerne are grown, consequently, there is a good food supply, and climatic conditions are favorable for this branch of poultry farming.

Essentials to success in turkey rearing are sound, healthy, breeding stock, careful feeding and management of the young birds, and marketing at the right time. Turkey rearing is increasing in popularity in Victoria, and there are various ways of making a start. Any of the following methods may be used.

PURE American Bronze is the most popular breed of turkey. The breeding stock should consist of eight to ten hens weighing at least 14 lb., mated with gobblers not less than twelve months old, and weighing from 24 lb. to 30 lb. They should have good width of body, long straight breast bone, broad plump breasts, and rather short legs. The value of birds when marketed is governed by the condition of the breast, and this factor should be carefully observed in the selection of breeding stock. This can be done only by handling, as it is not possible to select a bird on appearance alone.

Crooked breast of turkeys is a serious defect, and birds with this deformity should not be used for breeding. Although the weakness is apparently inherited, a deficiency in the diet may also be a contributing factor. Knobs or dents on the breastbone are quite common, and it is desirable to eliminate these defects with sound methods of breeding, feeding, and perching. Narrow, deep-breasted birds appear to be more susceptible to these faults than those with broad, well-fleshed breasts. Birds with arched backs, pendulous crops, and split wings, should be culled and never be used for breeding.

Progeny testing is strongly recommended as it is the most reliable and speediest method of improving the flock. With this system, the breeders are grouped in separate pens and the eggs from each group hatched separately and the progeny either toe-punched or wing-banded according to the markings of the male bird. The fertility, hatchability, and number of eggs from each breeding pen is recorded, and, during the rearing period, all data concerning mortality, rate of growth, body conformation, age, and weight when marketed is also recorded.

Progeny testing emphasizes the importance of the male bird with regard to breeding, as the young cocks from the outstanding families are reserved for breeding purposes each year. As rate of growth is inherited, the earlier maturing birds should be leg-banded, and all those that conform to the desired standard should be reserved for breeding.

Breeders should be confined to small yards, but not overcrowded. A good plan is to provide each group with two runs which can be used alternatively to reduce the risk of disease. All birds used for breeding purposes should be blood-tested just prior to the breeding season.

THE COMMENCEMENT

If a start is made with eggs, they can be hatched either under broody hens or in incubators. When broody hens are used, coops with runs attached should be placed in sheltered positions on a patch of grass or lucerne. A comfortable nest should be placed in each coop with soft earth and straw or pine needles. The eggs should be put in the nest and the hen placed on them at dusk. The bird should be treated for body lice by dusting with a good insect powder. It may be necessary to close the hen in for a day or so, after which she should be taken off the nest and given water and food consisting of either wheat, oats, maize, or barley, and shell grit. She should then be let out and will usually return to the nest after having had a run and a feed.

The incubation period for turkey eggs is 28 days. About two days before the hatch is due, the hen should be gently lifted off and once again dusted with insect powder, and then allowed to feed. By the time she goes back to the nest she will be free from vermin, and the chicks will have a clean start. Turkeys should always be handled very carefully.

After hatching, move the coop a few feet every day to give the chicks a fresh run. On the fourth day, the front of the coop should be raised a few inches to allow the chicks to run in and out, but the hen should still be kept inside. When the chicks are about a fortnight old, both mother and chicks should be allowed free range, and, when they are ten weeks old, a trestle frame about 2 feet high should be provided on which they can learn to perch. The perches should be not less than 3 inches wide, and the perching quarters should be enclosed with a 6-ft. wire netting fence as a protection against foxes.

THE INCUBATOR

Turkey eggs can be hatched in all standard type incubators, and the management is similar to that of hen eggs.

In sectional or still-air machines, a temperature of approximately 103° F. should be maintained throughout the incubation period, and, in electric cabinet incubators, a temperature of 100° F. with a relative humidity of 60 per cent. is recommended.

Eggs should be turned at least twice a day, tested on the tenth and fourteenth days, and transferred to the hatching compartment on the 24th day. Turning is discontinued when the eggs are placed in the hatching compartment. All eggs should be reasonably uniform in size and shape, sound in shell, and should weigh at least 2½ oz. each.

Artificial incubation is increasing in popularity, as larger numbers of poults can be hatched, time tables accurately arranged, and less labour is involved in attending to a reliable incubator than a number of sitting hens. The incubators should be thoroughly cleaned and disinfected after each hatch, and all equipment kept in a strictly sanitary condition.

The following method for the fumigation of incubators is recommended :—

Most machines are of the forced draught type, and the following recommendations apply to them.

The inside and trays of the incubator should be thoroughly scrubbed with a strong solution of washing soda, and allowed to

Fig. 1.—Two battery-type brooder sections showing coke boiler with hot-water pipe heating unit consisting of one 2-inch pipe outflow, and three 1-inch pipes to take the return flow. The pipes are 7½ inches from the wire floor. Trays to catch droppings are placed 4 inches below the wire floor, and 12 inches above the ground. The left-hand section shows hot-water pipes, without hover in position, and the mash trough tilted forward for filling.

The right-hand section shows the metal hover in position with flannel strips attached. The wire frame resting on the back portion of hover prevents the poults from flying over sectional partitions. A similar frame is placed over the front portion of each brooder. The food hopper is in correct position for feeding. Brooder sections measure 6 feet by 3 feet and provide accommodation for 60 poults. As the birds grow, they are transferred to lower sections of the brooder. (Fig. 2)

dry thoroughly before being used. The trays should then be dried in the open air. Before any eggs are placed in the machine, 1 fluid oz. of formalin to every 250 cubic feet of incubator space should be poured on to cheese cloth, and placed in the closed machine for 24 hours.

The volume of the incubator in cubic feet is determined by measuring its height, length, and breadth in feet, and multiplying these. When this is known, division by 250 gives the required amount of formalin in fluid ounces.

Should the machine not be of the forced draught type, the heating mechanism should be started, and the required amount of formalin placed on cheese cloth, and left in the machine for two days. A further two days is allowed with the heating mechanism still in operation, before any eggs are put in the incubators.

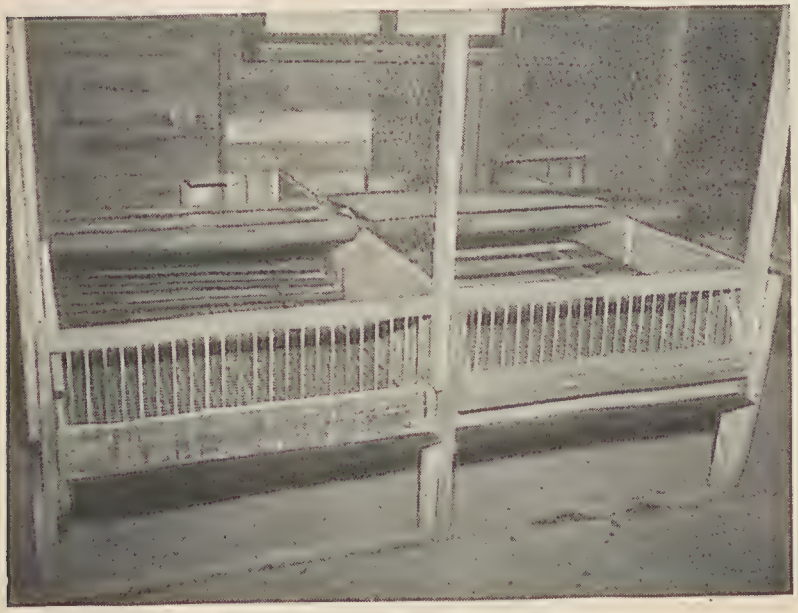


Fig. 2.—Two lower-end sections of brooder similar in construction to those illustrated in Fig. 1. The hot-water pipes are 10 inches above the wire floor and terminate at a header for return flow to the boiler. Pop holes in the front wall give access to either outside runs or sun porches. (Fig. 4.) Poults are allowed out when approximately three weeks old. The perching frames under hover in the left-hand section are 1-inch high, and those in the right-hand section are 2 inches high. The hover, made from sheet iron, is in position in right-hand section. Flannel strips are not used.

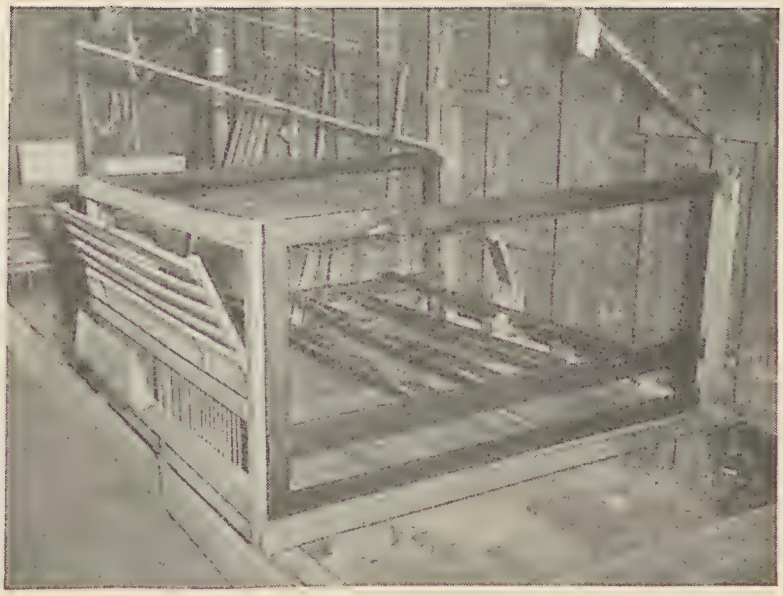


Fig. 3.—This cold brooder measuring 6 feet by 6 feet provides accommodation for 60 poults. The birds are transferred to the cold brooder when five weeks old. The wire floors and food hoppers are similar to those in Fig. 1. The perches are 12 inches from the floor and are removable. Pop-holes lead to either an outside run or sun porch. (Fig. 4.) The hinged door in the front wall provides entrance to the brooder and the suspended wire frame covers the top to keep the birds confined.

DAY OLD POULTS (BROODING)

Artificial brooding is essential for the rearing of day-old poults. Either electric, hot-water, kerosene heated or battery brooders may be used. Turkey poults require approximately twice as much brooder space as chickens.

Wire floors are recommended as they are sanitary and reduce the risk of overcrowding and sweating. A temperature of 95° F. should be maintained for the first week, and gradually lowered over a period of five to six weeks to 80° F.

Turkey poults are not as enterprising as chickens, and do not respond as readily to variations in temperature under the brooder. They need to be watched carefully during the first week.

A wire-netting hurdle 2 feet high should be placed around the hover about 18 inches away from the edge, to confine the poults to the brooder for the first few days. They

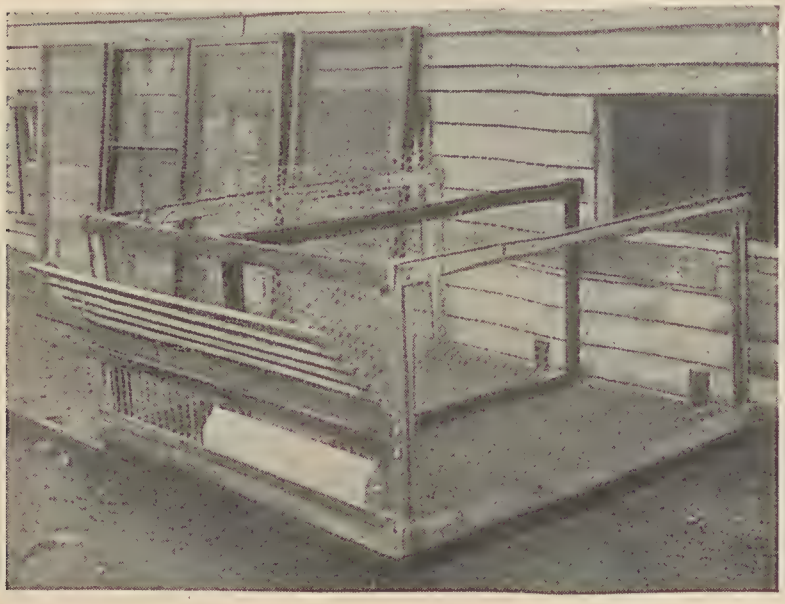


Fig. 4.—A sun porch similar in design to the cold brooder, (Fig. 3), except that no perches are used. Two sections are illustrated each measuring 6 feet by 3 feet. The poults enter the sun porch through the pop holes from the heated section of the brooders. The droppings fall through the wire floor to the ground. The sun porch is assembled in sections and dismantled, cleaned and disinfected in preparation for each fresh batch of poults.

soon learn to fly and it may be necessary to cover the space between the edge of the hover and the hurdle with wire netting to prevent them from straying away from the heat.

The poults may be given access to the runs or sun porches at approximately two to three weeks. They are transferred to cold brooders at five weeks, and moved out on to open range at approximately eight to ten weeks. Early perching should be encouraged and overcrowding avoided during brooding and rearing periods.

Brooder houses should be well ventilated and have movable windows to allow direct sunlight in on the floor. Similar types of food hoppers and drinking troughs used for chickens are also suitable for turkeys.

PARTLY REARED POULTS

Although supplies of partly reared poults (eight to twelve weeks) are not available in large numbers, this branch of turkey rearing is increasing in popularity. It does away with the trouble of incubation and brooding, and is a convenient system for farmers who rear turkeys as a side-line. The management of partly reared poults is dealt with in the section headed Free Range.

FEEDING

The feeding of turkeys differs only slightly from the feeding of fowls, so that the principles that apply to fowls apply equally well to turkeys. Although, as in the case of chickens, it is not usual to feed young turkey poults for the first 24 to 36 hours, they may be fed as soon as they will start to eat. The first feed should consist of a good chick mixture, which can be given either as a wet or dry mash. The usual custom is to have a dry mash always available, and to feed a wet mash twice a day. The wet mash can be eliminated if desired and dry mash only fed. At the end of three days, the wet mash can be fed once a day with a little finely chopped, tender greenfeed added.

Skim milk may be used for mixing the mash, and also for drinking purposes. From eight weeks onwards, whole wheat and oats with cracked maize can be given. The grain is gradually increased until the birds are approximately six months old when even quantities of mash and grain are being fed.

Coarsely ground mashes are preferred to those ground too fine. This is important when feeding dry mash, as it tends to stick to the inside of the mouth and is difficult to swallow.

An adequate supply of fresh greenfeed, shell grit, and clean drinking water should be always available for the birds from the commencement right up to the time of marketing. Charcoal should *not* be included in feeding rations for poultry as it interferes with the normal assimilation of foodstuffs.

Extra food should be fed to birds for three or four weeks before marketing to ensure that they are in prime condition. Rapid growth is desirable in the rearing of table poultry, and the maximum quantities of flesh-forming foodstuffs, such as meatmeal or dried buttermilk, should be fed during the early stages of growth, and gradually reduced as the birds reach maturity.

Palatability helps to increase food consumption, and, therefore, all mashes should be made as palatable and attractive as possible, if maximum growth is to be obtained.

Pellet feeding has given satisfactory results, and the increased cost is partly compensated for by the saving of labour and the minimum of wastage.

Rations

The following feeding rations are recommended from day-old to twelve weeks :—

Chickens must be fed well right from the commencement on nutritious foods. The ration should include foods rich in protein, and low in fibre, such as meatmeal, meat, or milk and its products.

Food and water may be given about 24 hours after the chickens are hatched, but the amount eaten will be small during the first day or two. It makes little difference if they are not fed until 48 hours after hatching, but, if delayed too long, the chickens may become ravenously hungry, and eat too heavily at the first feed.

Poultry keepers in a small way may find it more convenient to use reliable commercially mixed foods rather than buy the ingredients and mix their own, but it is much cheaper to buy the ingredients and mix the foods on the farm.

There are many rations and feeding systems used by poultry farmers, and, if good results are obtained, there is no reason to

change, but the following mash mixtures with cracked grain and greenstuffs have given good results :—

—	Mixture 1.	Mixture 2.	Mixture 3.
	lb.	lb.	lb.
Ground wheat ..	40	30	50
Ground hulled oats	20	10	30
Ground maize ..	20	40	..
Bran	10	10	10
Dried buttermilk ..	10	5	..
Meatmeal ..	..	5	10
Common salt ..	½	½	½

If desired, 3 lb. of bone meal or 2 lb. of di-calcic phosphate may be added to the above mixture. These can be given as dry or wet mash. The usual custom is to have a dry mash always available, and to feed a wet mash a couple of times a day.

They can be fed from the first feed when the chicks are about a day-old, until they reach maturity, or until they are well grown, and then they can be fed on an adult ration. For the grain portion of the ration, 60 lb. of cracked wheat, 20 lb. cracked hulled oats, and 20 lb. of cracked maize make a very good mixture.

If maize is unprocurable, cracked and ground wheat and oats may be fed in its place. Portions of the ground wheat and ground oats may be substituted with ground barley. Ground grains are more nutritious than the various by-products meals, such as bran, pollard, &c. Fine shell grit should be always available in separate hoppers for the chickens.

Greenfeed

It is important that the chickens should receive as much tender green feed as they can eat at least once a day. A liberal supply of fresh and clean drinking water should always be at hand. With proper management and a variety of plain, wholesome and nutritious foods, the chickens are provided with all the nourishment and vitamins necessary for their health and growth. The chickens should also be exposed to direct sunshine, as this is necessary for proper bone development and the prevention of rickets.

In the absence of greenstuff and exposure to direct sunshine, a reliable brand of cod liver oil, or oil rich in vitamins A and D may be added to the mash as a vitamin supplement.

Proper food and water vessels should be provided to keep the food clean and prevent waste, and they should be placed in positions where the chickens cannot walk into them.

Sanitation

If chickens are to do well, it is important that they be bred from strong, vigorous, healthy stock. It should be remembered also that diseases, constitutional weaknesses, vices, &c., can be prevented by providing the chickens with comfortable quarters, clean floors, and runs, proper heat and ventilation, outside exercise and sunshine, a correct diet with ample green feed, and regularity in management. Be sure to practice strict sanitation.

Rations for the older birds

The following rations are recommended from twelve weeks to maturity :—

Mash.	lb.
Bran	30
Wheat pollard	50
Maize meal, or oat pollard, or barley meal	10
Meatmeal, or dried buttermilk	10
Or meatmeal *and*	5
Dried buttermilk	5
Grain.	
Wheat	60
Oats or barley	20
Maize	20

As a dry mash the meal foods are mixed together and fed in hoppers to which the birds have access at all times. Chaffed greenfood is fed separately.

How to mix the mash

When used as a wet mash the ration may be mixed as follows :—The bran and meatmeal are mixed together, then moistened with the liquid to be used, dried off with the pollard and other fine meals, and approximately 25 per cent. of chaffed green feed is then added, the whole being formed into a nice crumbly mash. This is fed regularly each morning in clean troughs. Some chaffed greenfood may also be fed

separately. If cooked meat, such as bullocks' heads, livers, &c., are used in place of meatmeal or dried buttermilk, the mash should be mixed with the soup. A little less than two-thirds of an ounce of the cooked meat should be allowed per bird per day, or approximately 4 oz. per week.

Table salt may be added to either the wet or dry mash in the proportion of ½ lb. to 1 lb. for every 100 lb. of mash, weighed dry. This amount should not be exceeded, and care should be taken to allow for any salt present in other ingredients of the ration. The kind of fine salt for stock purposes is cheaper than the household variety. The salt should be thoroughly mixed through the dry mash, and for the wet mash it should be properly dissolved in the liquid or soup with which the mash is to be made, to ensure an even distribution.

Shell grit should always be available, and a liberal supply of pure cool water should be kept constantly before the birds. Strict attention to cleanliness in the use of food and water vessels is essential in order to keep the birds in perfect health.

FREE RANGE

When turkeys are reared in small numbers, it is usual to provide roosting sheds where they can be locked up during the night-time. However, when reared in large numbers, roosting sheds are not used, as turkeys rear well on the open-air perching system.

The perches should be placed in sheltered spots in enclosed runs with fences of sufficient height to guard against foxes. A grain feed should be given in the evening to encourage the birds to return to the roosting quarters. Perches should be approximately 3 feet from the ground, placed 2 feet apart, made from 3 inch or 4 inch x 2 inch hardwood, with the broad surface upwards and the edges planed off. The supports should be strongly built and the perches removable in order to control red mite and also to facilitate the removal of the droppings.

Extensive acreage is essential for success, as limited areas become highly contaminated and increase the risk of disease. The carrying capacity of land varies with the quality of the soil, the type of country, whether flat or undulating, the amount of natural drainage, and general climatic conditions. Under favorable conditions, 1 acre is sufficient for 50 turkeys, but larger areas are desirable and should be provided when available.

Either alternative or rotational runs are recommended as this allows each run to be spelled for one or two seasons according to the system in use.

Shade is necessary during the summer, as continual exposure to hot sunlight and hot winds tends to lower food consumption and retard growth.

A couple of well trained sheep dogs are invaluable in controlling turkey flocks, particularly when birds are ranging over large areas.

MARKETING

Turkeys should be marketed as soon as they are in prime condition. Six to nine months is the usual age to market turkeys, although large numbers are retained until they are at least twelve months old. The flesh of young birds is much superior to that of older birds, and every effort should be made, per medium of breeding and feeding, to have them ready for market as early as possible.

Size is important, but values are assessed mainly on condition and quality. There are always a number of rejects in every flock, due to disease and deformities, and these should be disposed of immediately they are recognized. Undergrade turkeys are a burden on the market and have an adverse effect on the industry.

When forwarding birds to market, they should be graded to size. Small birds should not be crated with larger ones or they may be damaged or trampled on during transit. Even grading makes marketing easier, and, if reliable weights are marked on the consignment tags, it inspires confidence between producer and agent.

When despatching turkeys by rail over long distances, they should be confined to small runs or sheds for 24 hours before crating, and given all the food and water they can consume in order to prevent loss of weight and quality during transit.

Turkeys should be handled carefully as they bruise easily, and the majority of these bruises occur while the birds are being handled for market. Slight flesh or skin bruises show a faint discolouration and are not a serious fault, but old or more serious ones show up as dark brown or green spots and considerably reduce the value of the

birds. Turkeys should be carefully placed in the crates and not pushed roughly through the openings and allowed to fall heavily on the floors. They should be held firmly by the shanks and one wing to prevent flapping, then lowered into the crate and placed gently on their sides.

A leg hook should never be used to catch birds, as the sudden impact of the breast on the ground causes bruising. Turkeys become very tame and can be easily caught by the person who regularly attends to them.

Fowl crates should never be used for the marketing of turkeys. The standard size turkey crates provide ample height and space to permit the birds to stand upright and move around in comfort. Not more than eight cock turkeys should be put in one crate; if they are very large, seven is enough, and not more than ten hens.

The crates should have at least 6 inches of straw in the bottom. This will make them more comfortable and also lessens the risk of birds becoming injured.

Burnley Egg-Laying Competition

Progress Totals—265 Days

The number of first-grade eggs laid to 21st December, 1948, by the leading fowls in each class of the Burnley Egg-laying Competition, together with the names of the birds' owners, are set out in the following tables. The tests, which are being conducted at the School of Primary Agriculture and Horticulture, Swan-street, Burnley, commenced on 1st April, 1948, and will conclude on 2nd March, 1949, a period of 336 days. First-grade eggs, during the first two months of the competition, must weigh not less than 1¾ oz. and not less than 2 oz. thereafter.

Class 1.—White Leghorns—Wet Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
147	Hill, H. E.	241
146	Goddard and Harvey	237
142	Gibb's Highway Stud	233
128	Abikhair, Les	232
160	Lowe, G. R.	228
154	Sunridge Poultry Farm	215
139	Bonview Poultry Farm	214

Class 2.—White Leghorns—Dry Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
235	Skinner, A. A.	227
205	Clements, W. H.	222
229	Moran, G.	222
230	Moran, G.	215
231	Roberts, Miss A. E.	211

Class 3.—Light Breeds, other than White Leghorns—Wet Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
104	Chalmers, H. L. (Legbars)	183
119	"Glenyuille"	182
105	Doull, J. (Legbars)	179
126	Woollett, C. J. (Legbars)	177
120	"Glenyuille"	176
102	Bruce, J. L.	174

Class 4.—Australorps—Wet Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
31	Hanson, S. H.	219
35	Paton, W. S.	218
7	Casper, A. and L.	216
4	Beswick, A. G.	215
10	Clark, F. A.	212
19	Head, E. A.	212

Class 5.—Rhode Island Reds—Wet Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
76	Fraser, D. R.	193
89	Mills, J. J.	190
98	Wear, J.	187
63	Seven Acres Poultry Farm	182
90	Mills, J. J.	178
96	Wakeham, W. M.	177

Class 5.—All Heavy Breeds, other than Rhode Island Reds and Australorps—Wet Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
54	Cocking, W. (Light Sussex)	153
58	Lang, J. (Langshan)	137
56	Wilkinson Bros. (Light Sussex)	134
57	Lang, J. (Langshan)	116

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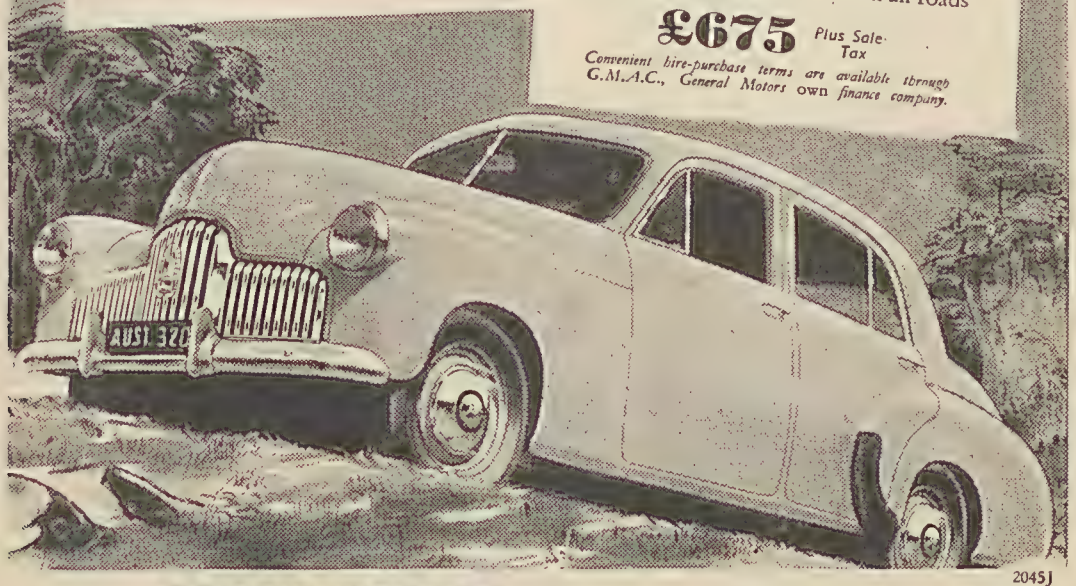

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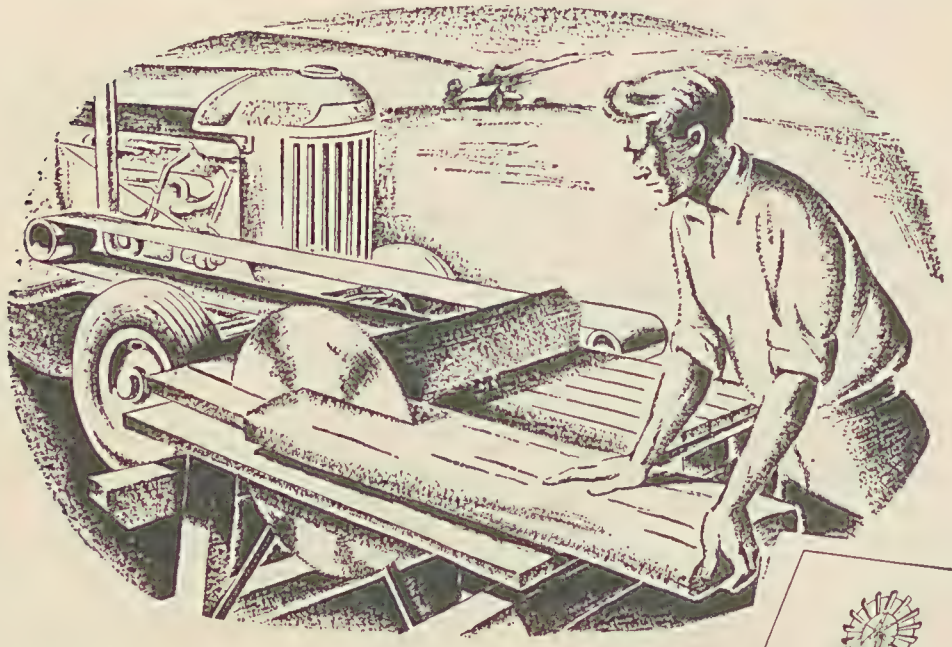

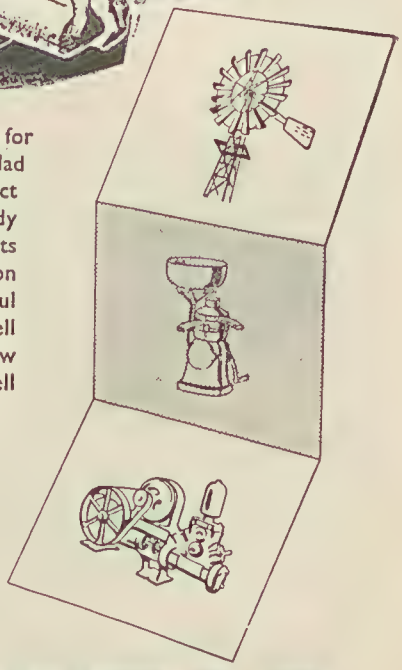

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LIVE STOCK NOTES

Compiled by
A. C. T. HEWITT,
M.Agr.Sc.
Live Stock Science Officer

PRODUCING QUALITY BACON PIGS

THE drop in pig prices which occurred in November was accompanied by more selective buying by the curers. The result was that heavy overfat pigs were harder to sell than lighter prime quality pigs.

The latest returns show that reserve stocks of bacon and ham were higher than at the corresponding time last year, but total production for the first nine months of 1948 was slightly less than for the same period of 1947. This appears to be due to a reduced public demand for bacon and ham, which have greatly increased in price since the lifting of price control. The public may also be showing more discrimination in the quality of bacon it is buying and this may explain why leaner pigs are more in demand.

The aim of every pig raiser should always be to sell his pigs at their prime and not when they reach a fixed weight. It is a difficult process to carry early-maturing strains to heavy bacon weight and still produce a prime carcass. It is also false economy to try and do so with feed costs rising as they are. The overfat pigs will be a drug on a market which is showing definite signs of demanding quality instead of quantity.

As stated in previous issues of this Journal, the Department of Agriculture has a scheme under which farmers may ask for their pigs to be appraised free of cost at their particular bacon factories. From the results obtained, faults in feeding and breeding may be revealed and steps may then be taken to overcome them.

Feeding plays an important role in the growth of any animal. The body of an animal is composed of three main types of tissue—bone, muscle, and fat. In the early life of an animal bone is developing at its greatest rate and therefore in the prenatal and suckling period the supply of a liberal quantity of bone-building food is essential. Soon after birth all young animals begin to grow very quickly and this increase in weight is mainly muscle. Muscular development demands a liberal supply of good protein, and for the young animal milk is very important. If skim milk is unobtainable after weaning, meat meal is a good substitute.

In time, varying according to individual animals, deposition of fat outstrips the development of muscle and soon after that occurs the pig is at its most desirable stage for slaughter.

Food rations must provide animals with six essentials in the right proportions. These essentials are water (a pig requires $1\frac{1}{2}$ gallons daily); proteins, carbohydrates, fats, minerals, and vitamins. Proteins and minerals are important for rapid muscle and bone building. The essential fats are usually supplied in normal balanced rations. Carbohydrates are in abundant supply in all grains. Vitamins are most easily supplied by providing plenty of green feed and making provision in all sheds and sties for ample sunshine, especially for young pigs.

[A. D. NORTH, B.Agr.Sc., Science Field Officer.]

EGG, BACON, AND FEED PRICES

The graph shows the maximum wholesale prices of first-quality hen eggs, first-quality bacon sides, bran and pollard and feed wheat. In the early years of the war there were considerable variations in the price of hen eggs, and in 1940 the price for bran and pollard rose from £4 to £6 per 2,000 lb. By 1942 prices generally settled down under price fixing with stable prices for bran, pollard, and wheat, and levels of prices for eggs and bacon which gave producers reasonable margins.

Since the end of the war, there have been rather big increases in prices of all the commodities. These prices are now being felt by poultry and pig farmers, as bran and pollard have risen by 82½ per cent. and wheat prices by over 100 per cent., whereas prices of eggs and bacon have risen by less than 50 per cent. Although the prices of eggs and bacon have increased by 50 per cent. the producers are receiving little more for their eggs and pigs as the levies from eggs have been raised considerably and the prices of pigs at auction are little higher than during the war years. [A.C.T.H.]

STOCK FOOD PRICES

Oats can be fed safely to all animals with good results, and at present prices they are the cheapest stock food.

For pigs, oats should be crushed. In trials at the Rutherglen Research Station, oats replaced one-third of other grains in pig rations without any detriment to growth rate. Many pigs are reared entirely on oats and a protein supplement, and on to-day's prices there is a big margin in favour of this method of feeding.

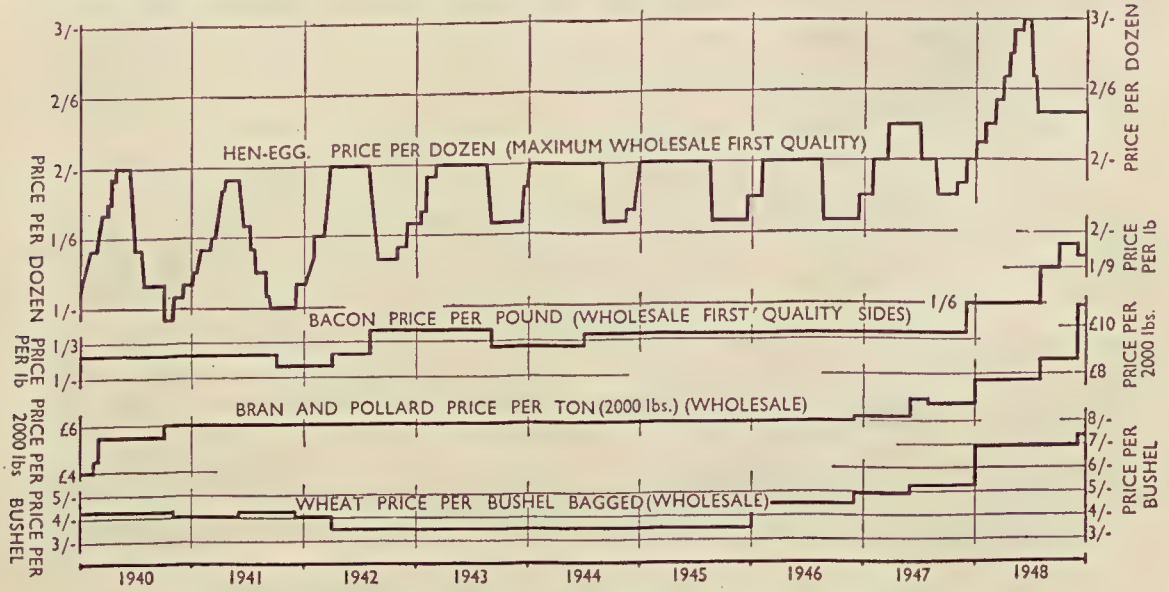
In feeding tests with poultry at the State Research Farm, Werribee, oats have been found little inferior to wheat, and at present costs poultry farmers could introduce quite large percentages of oats into the rations with advantage.

OAT, WHEAT, AND POLLARD PRICES.

	Wholesale Price.		Comparative Price with Oats at 3s. 6d. per Bushel.	
	Per Bushel Bagged.	Per lb.	Per lb.	Per Bushel.
	s. d.	d.	d.	s. d.
Oats	3 6	1·05	1·05	3 6
Wheat ..	7 5¼	1·49	1·22	6 1¼
Pollard ..	2 2	1·31	1·17	1 11½

From the table it will be seen that wheat is costing 1s. 4d. per bushel and pollard 2½d. per bushel more than oats on a comparative food basis. The extra cost of feeding 2,000 lb. of wheat or pollard instead of oats is about £2 5s. and £1 3s. respectively.

[A. D. NORTH, B.Agr.Sc., Science Field Officer.]



Monthly prices of eggs, bacon, bran and pollard, and wheat, 1940 to 1948.

THE DEVELOPMENT OF BRITISH BREEDS OF DAIRY CATTLE

The first records of cattle being kept in England were made by the Romans following the invasion of Julius Caesar in 55 B.C. The Romans mention the small black Celtic ox found in England on their arrival. To-day the Kerry cattle of Ireland and the small black cattle native to the Arran and Shetland Islands resemble the black Celtic ox more than any other breeds. The black Welsh cattle, Aberdeen Angus and Galloways also resemble the original Celtic ox to some extent.

At the time the Romans came to England and for many years later, the cattle in Tuscany and Lombardy, along the Po river valley in Italy, were the most improved breeds, and the Romans took some of them to England. In the first place the cattle were taken to provide meat for the armies, but subsequently were used to improve the native stock. These cattle were large, had level top lines, broad backs and good beef and milk producing qualities.

The breeds of modern cattle showing most characteristics of these ancient Lombard cattle are the large-framed breeds, Shorthorn and Friesian. The Lombard cattle were mostly fawn and dun in colour, with white under-parts and some white along the back, and it is quite possible that the modern Longhorn and Hereford breeds have inherited their colour patterns from them.

Successors to the Romans in England, the Angles, Saxons, and Jutes, and later the Danes and Norsemen brought cattle with them. These cattle, which were mostly brindle, red or fawn in colour, are believed to have had a big influence on English cattle.

These invaders, however, did little to improve the cattle, and it was not until the 15th and 16th centuries that renewed interest was taken in cattle improvement. During this time Flemish and Dutch cattle, which had been improved by the further use of Lombard cattle, were introduced to England to improve English breeds. These and later importations were responsible for increasing the size, improving conformation, and adding the colour markings for many of our modern breeds.

Little progress was made, however, until the advent of Robert Bakewell (1725–1795) of Dishley, Leicestershire, the founder of systematic animal breeding in England. Bakewell concentrated on breeding Longhorn cattle and although the breed has not become famous, his lessons and methods of breeding which were essentially better feeding and culling, were adopted by enterprising farmers in various parts of England where improvement of the local cattle into the present-day breeds began.

The great improvement in the many British breeds of cattle was brought about by working systematically on natural laws :—

1. By the fusion of different breeds and types.

2. By mating selected animals showing the desired visible characteristics.

3. By rigid culling.

4. By better feeding, aided by improved pastures.

Following Britain's example, increasing numbers of breeders in Australia have improved their methods of feeding, culling, and the selection of sires. This has resulted in the production of cattle comparable with those in other parts of the world.

The natural laws cited above are still the basis of commercial animal breeding, but for the further improvement of our farm animals, more attention will have to be given to progeny testing and the wider use of males capable of siring progeny better than the average.

[A.C.T.H.]

BOVINE TRICHOMONIASIS

A Cause of Infertility in Cattle.

Trichomoniasis, a contagious disease of cattle can be a big factor in causing infertility or even sterility.

This condition is venereal and the bull is the chronic source of infection. The organism causing the disease is a protozoon called *Trichomonas foetus*. It was discovered toward the end of the last century, but has been fully investigated only during the past twelve years.

The results of the investigations indicate that trichomoniasis is universally distributed. However, the full extent of losses to the dairy and beef industry is not known, due mainly to the difficulties involved in positively diagnosing the condition.

A history of many cows in a herd returning to the bull six to twelve weeks after service will arouse the suspicion that they have been infected with trichomoniasis by the bull. The majority of these cows actually conceive, but abort within twelve weeks.

Aborted foetuses, if found, are 2 inches to 4 inches in length, and will provide one of the most reliable means of diagnosis, as fresh specimens contain numerous trichomonads. In addition, immediately after abortion a thin flaky vaginal discharge from the cow may be seen. This is usually teeming with parasites. Any foetuses or discharges submitted for examination must not be more than a few hours old, as the organisms die very rapidly.

Not all cows served abort; firstly, because at times organisms are eliminated from the bull intermittently, and some cows may not be infected; secondly, some cows may be immune due to previous contact. A small percentage of cows may develop pyometra (pus in the breeding bag) instead of a calf, more than a gallon of pus teeming with organisms being found on occasions.

The majority of cows recover spontaneously if they are allowed a rest for at least three regular successive oestral periods. Bulls seldom recover. These facts are used as a basis for control measures.

When most cows in a herd return at regular intervals, a weak or sterile bull is the possible cause. A few cows returning in a herd at irregular intervals suggests non-infective causes.

Contagious abortion can be substantiated by blood agglutination tests, coupled with a number of abortions at five to eight months (rarely less), and infertility.

Where bovine trichomoniasis is suspected, the following control measures are recommended:—

(*a*) Send all bulls to the abattoirs, and buy replacement bulls as calves. Ensure that all fences are bull-proof.

(*b*) Keep all empty cows (including cows which have calved normally) away from the bull for a least three normal and regular heat periods.

(*c*) Buy replacement cows as in-calf heifers.

Trichomoniasis is scheduled under the *Stock Diseases Act* 1928, and owners must immediately report all suspected cases to the Chief Inspector of Stock, Department of Agriculture, Melbourne, C.2.

[A. ENGEL, B.V.Sc., Veterinary Officer.]

TABLE POULTRY

Table poultry production is becoming a profitable branch of the poultry industry. prior to the present demand, which developed during the war, table poultry supplies consisted almost entirely of birds culled from commercial egg-producing farms. Cockerels and pullets culled for various reasons met the requirements of the chicken and cockerel trade, while turkeys, ducks and geese, have always been bred for table purposes.

The enormous expansion which has taken place in the export trade of dressed poultry was never fully anticipated and breeders and exporters should be congratulated on the efficient and business-like manner in which they have dealt with this rejuvenated branch of the industry.

Such rapid development has brought into use many new types of equipment which were previously only in the experimental stage, and consequently many problems have arisen through its general use.

Battery brooders and rearing cages are widely used and in the absence of reliable experimental information it is difficult to decide whether the battery system is superior to the usual method of rearing intensively in sheds or in sheds with small runs attached.

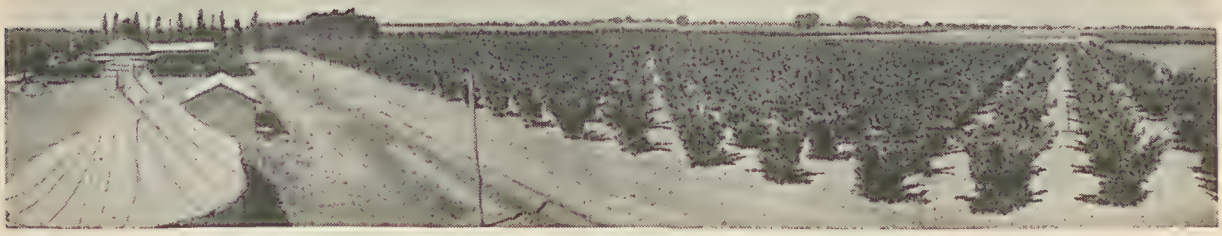
One advantage of the battery system is that it conserves space, but owners who were once staunch advocates of the battery system are inclined to think that better results are obtained during the topping-off period by transferring birds to small sheds with runs attached. Birds react favourably to the change in environment by an improvement in the condition of the breast and an acceleration of feather growth.

Breeds such as Rhode Island Reds and Light Sussex, which are favoured by exporters, are losing favour with battery users because of slow feathering and the great difficulty in bringing the birds up to prime condition.

At the present juncture it would appear necessary to transfer birds of the above-mentioned breed to sheds for the topping-off period. This is not the case with crossbreds, particularly those crossed with White Leghorns. These breeds evidently inherit the factors for quick feathering and rapid development which are essential for birds confined to batteries.

(continued on page 28.)

Field Day, Horticultural Research Station, Tatura



Panoramic view of the Horticultural Research Station, Tatura.

THE annual field day was held at the Horticultural Research Station, Tatura, on 30th November. Opening proceedings, the Chief Inspector of Horticulture, Mr. F. M. Read, stated that the main discussion during the afternoon would deal with fruit size in relation to canning peaches. Mr Read had recently visited California, where the subject of fruit size was of major importance. It had been found that there was a high correlation between the size of fruit ten days after stone hardening and the size of fruit at maturity. As a result of work extending over a period of more than fifteen years, the main canning companies now sent a team of men through the peach orchards about ten days after stone hardening to take careful measurements of fruit size. From the tens of thousands of observations made, it was possible for shareholders to be accurately advised concerning the amount of thinning required to obtain maximum crops of peaches of canning size.

The following are summaries of lectures given at the field day :—

FRUIT SIZE AND NORMAL FRUIT GROWTH

The Manager of the Station, Mr. R. S. Harper, addressing visitors on fruit size and fruit growth, pointed out that most of the investigational work at Tatura had been concerned with improvement of the yield and quality of canning peaches. Quality was considered in all the investigations, but the chief line of attack on this problem was by breeding, selection, and introduction of new varieties.

The question of fruit size, however, was a most important one, and the aim of the grower was to produce as much fruit as possible above the minimum canning size of $2\frac{3}{8}$ inch or $2\frac{1}{2}$ inch. Size is usually expressed in terms of diameter, but this is really a coarse measure because small increases in diameter result in large increases in volume, and, therefore, weight of fruit. For instance, 8,500 peaches of $2\frac{3}{8}$-in. diameter make 1 ton of fruit, while 8,500 peaches of $2\frac{3}{4}$ inches make $1\frac{1}{2}$ tons of fruit.

It wasn't possible, however, to grow a crop of fruit of 100 per cent. canning size and obtain the maximum possible crop. Trees carrying the maximum quantity of fruit of canning size will also carry a certain amount of small or undersized fruit.

In understanding the factors affecting fruit size, it was necessary to know the changes which occur during the three main growth periods. During the first eight weeks after fruit setting, growth was fairly rapid, but, during this period, there were three separate waves of dropping due to unsatisfactory fertilization of the embryo. Fruit which remains on the tree after this

first growth period usually remains until harvest time, unless removed by wind, hand-thinning, &c.

At the end of this first period the stone had reached maximum size but had only a thin layer of flesh. Then the outward growth of the peach almost stops for a period which, in the Golden Queen, is ten to eleven weeks. For early varieties, such as Levis, this period was shorter, and for later varieties, longer. Early in this period the stone hardens and later the kernel becomes fully developed. Rapid growth of the peach up to picking time then occurs. For the Golden Queen this last period was of about five weeks' duration, and commences about the first week in February. The fruit almost doubles its size during this final swell.

EFFECTS OF FERTILIZERS, PRUNING, AND THINNING

Dealing with the subjects of pruning, thinning, and the effects of fertilizers on yield, the Senior Horticultural Research Officer, Mr. C. E. Cole, stated that from previous experiments it was known that applications of sulphate of ammonia to peach trees resulted in increased fruit size and yield compared with trees receiving no fertilizer.

In the peach fertilizer trial at the Station, rates of application of 6 lb. and 3 lb. per tree were compared in an attempt to discover the most economic application.

Trees receiving a higher dressing made more shoot growth in 1947, but this difference was unwittingly removed as a result of slightly heavier pruning of high-nitrogen trees, so that these trees carried a crop of about the same size as trees receiving a lower dressing.

The point arises here that there is a definite relationship between the number of shoots and the size of crop when "distance" thinning is practised, so that trees which receive fertilizers and produce more shoots should be encouraged to produce bigger crops by lighter pruning.

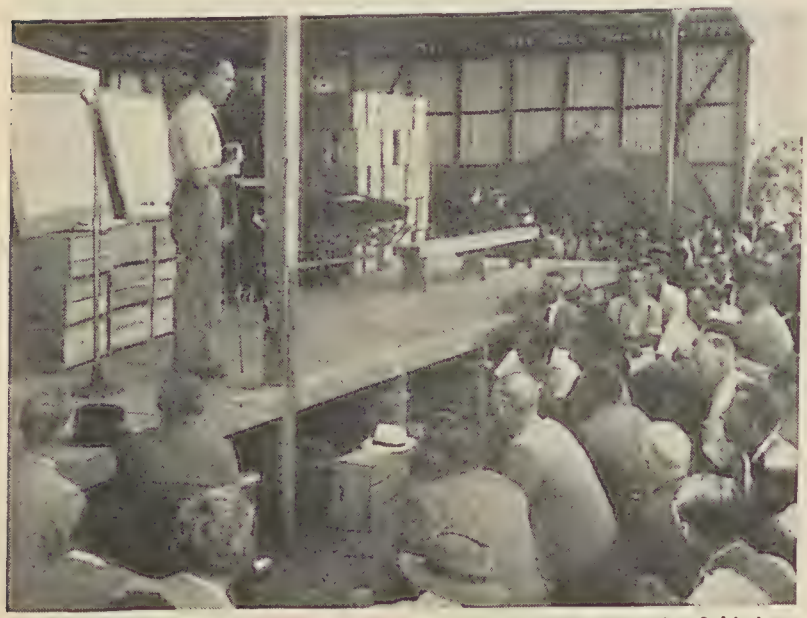
By dividing the sulphate of ammonia into two separate applications in August and February, more and longer laterals were obtained, and the following season a greater crop of fruit.

The higher nitrogen dressing had no immediate effect on fruit size. If it had, the February dressing of sulphate of ammonia would have produced a much bigger effect on the fruit crop, and the "high nitrogen" trees would have outyielded the "low nitrogen" trees.

Fruit size depends partly on the number of leaves, about 80 leaves per fruit being required for best growth of peaches. Good irrigation and fertilizer practices give good shoot and leaf growth, which result in good fruit size.

In the fertilizer trial, superphosphate and potash applications have not produced any consistent effects.

The size of the fruit is also controlled by the number left on the tree. The greater the number of fruit on the tree the greater the total weight of fruit. The weight of fruit of canning size also increases with the total number up to a certain stage, and then falls away as the number of undersized fruit increases. It has been



The Research Station Manager, Mr. R. S. Harper, lecturing at the field day.

found that a tree carrying 10 to 15 per cent. of undersized fruit at harvest time carries the most profitable amount of canning fruits. The number of fruit to be left on each tree depends on variety, vigour, soil fertility, and water supply.

Pruning is an unsatisfactory method of controlling fruit numbers, and hand thinning for the Golden Queen variety is the most satisfactory. The best time to thin is from mid-November onwards after the last natural drop has occurred. At this stage it is possible to observe differences in size which will persist until harvest, and it pays, therefore, to remove the smallest fruits. Thinning by "distances" does not give good control of fruit numbers, so thinning should be guided by actual sample counts.

Water measuring device for irrigation experimental block.

Growers should estimate tonnage which trees can carry, and allow 100 to 110 fruits per tree for every 2 tons per acre for average size of 2½-in. fruit. For example, a 10-ton crop requires about 550 fruits per tree on an 18-ft. x 18-ft. planting. Some average-sized trees should then be thinned to this number, and the number checked by counting. Regular spacing of the fruit is not important. These average trees will then serve as a guide for thinning the rest of the block.

Pests and diseases, such as aphis, mites, and rust, are factors which, if not properly controlled, will also affect fruit size.

EFFECTS OF WATER SUPPLY ON FRUIT SIZE

Mr. A. G. Goudie, Horticultural Research Officer, dealt with the effects of water supply on fruit size.

On the experimental peach irrigation block, detailed circumference measurements of individual fruits are made throughout the season. It has been found that, as soon as there is a shortage of soil moisture, the fruit stops growing even before the tree shows any signs of wilting, and if the soil remains dry for four to five days the fruit starts to shrink. The size lost during these periods of moisture shortage is not made up during the remainder of the season.

If the "no-growth" period amounts to ten or twelve days, it may not matter very much. However, on most orchards where difficulty is experienced in getting the fruit up to size it is probable that the fruit has had a total of 25 to 30 days of "no-growth".

If the soil is tight and impermeable, difficulty is experienced in obtaining satisfactory water penetration, and, unless some means are available to forecast the irrigation requirements of the tree, it is quite likely that the number of no-growth periods will add up to 30 days.

On more permeable soil types which are wetted to about 2 feet and take about 4 inches of water from each irrigation, there is less likelihood that the fruit will stop growing.

On the irrigation block of Golden Queen peaches at the Station penetration is extremely difficult, and the soil is wetted to an average depth of 10 inches in the summer. It has been found that on this block the fruit stops growing when water loss from an evaporimeter is 3 inches. Daily evaporation figures, which vary from ·2 inch on a mild day to ½ inch on a hot, windy summer day, when added up from the date of the last irrigation can be used on this property to predict the time for the next irrigation. The irrigation interval is usually seven to ten days in mid-summer. However, until a survey of permeability

is made throughout the district, this method cannot be used for general forecasting of irrigation requirements.

On this block last year the trees were thinned to carry a heavy crop with about 10 to 15 per cent. under size, according to the method previously outlined by Mr. Cole, and irrigation was applied according to fruit measurements. Ten irrigations used took a total of 18 inches of water, and the result was a 12-ton per acre crop, 85 per cent. being of cannery size. This heavy crop does not appear to have affected this season's crop, and it is intended to continue to crop the trees to capacity.

An experiment to improve penetration is in progress and the whole block has been laid out with various treatments, which include permanent covers of white clover, lucerne, and subterranean clover, weed control by summer cultivation and kerosene spraying, winter cover crops, and miscellaneous summer herbage.

The kerosene-sprayed uncultivated plots are looking healthy, probably because of the extra 3 inches of soil which is available to the tree roots without other competition. Plots sown down to permanent leguminous cover require extra nitrogen, and applications of 2½ lb. and 5 lb. of sulphate of ammonia per tree in both August and February are being compared. This experiment is of a long-term nature, and it is not expected that the effects will be gauged for a number of years.

SUMMARY

Control of fruit size depends principally on three things :—

(1) Control of number of fruit on a tree, chiefly by thinning, according to its capabilities.

(2) Control of water supply to ensure continuous growth of the fruit.

(3) Control of pests and diseases.

A vote of thanks to officers for their lectures and for the work being carried out by the Research Station Staff was proposed by Mr. W. Young, President of the Northern Victorian Fruitgrowers' Association.

LIVE STOCK NOTES—*(continued from page 24).*

White Leghorns crossed with either Australorps or Rhode Island Reds are satisfactory as they feather quickly and develop well-fleshed breasts at approximately three and a half to four months old.

Pure-bred White Leghorn cockerels, although the least popular of all the breeds, still continue to be profitable during the off season, but their value drops considerably from November to March when the markets are heavily supplied with birds incubated during the normal hatching season.

Australorp cockerels must be fully feathered as the short black pin-feathers are difficult to extract, and spoil the appearance of the dressed bird.

It is not possible to assess the true value of the battery system until such time as all prejudices have been overcome and reliable tests have been carried out with this type of equipment.

[M. D. Hall, Poultry Expert.]

BEEKEEPING

A great number of colonies of bees are now concentrated in the Western District, waiting for the Red Gum bloom.

Much honey has been gathered from Yellow Gum, Banksia, and Mallee, and much of it is of inferior quality as it was contaminated by a fair amount of honey from broom and manuka.

From Mansfield right across the central districts to the South Australian border, Red Gum has budded well and much good honey should be available from this source.

Autumn budding is short, and many apiarists may be forced to use Red Gum for winter stores. Except for isolated districts in the South-West and North-East, little surplus autumn honey can be expected.

A good quality honey is at present being extracted in the Moralla–Balmoral–Harrow–Edenhope district, from Yellow Gum. Good colonies have been storing up to 60 lb. in a five to six-day period during the good weather.

[W. A. Collins, Apiary Inspector.]

H.E.T.P.

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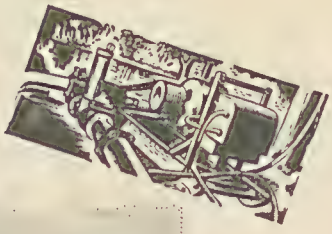
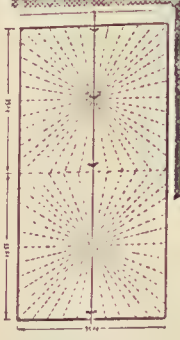


IN OVER 20 YEARS



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The "Webb-Way" follows the contour of the land—the fall of rain is even—no dry patches—no over-lap or over-watering. It is as even on the hillside and on the top as at the first section on the creek-bank.

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DESIGN FOR A SEPTIC CLOSET

By
E. A. HEPBURN, B.C.E., A.M.Inst.C.E.
Sanitary Engineer, Public Health Dept.

THERE is a widespread desire on the part of householders outside the sewered areas, and particularly those not served by a municipal sanitary service, for some means of overcoming the disadvantages of the pan closet, particularly when the objectionable job of emptying and cleansing the pan is the responsibility of the householder himself. For premises with an adequate water supply and with a sufficient area of reasonably absorbent soil in which to dispose of the effluent, the septic tank is the best solution.

For the farmer, or dweller in a small township who is dependent on roof catchment for his water supply, a septic tank is not a practicable solution, and some alternative must be sought. In areas where such are permitted by the council, a deep pit latrine or a borehole latrine may be a solution, but each involves deep excavation, the borehole latrine needs to tap a porous and preferably water-bearing formation, and neither is permissible within a long distance of any underground tank, well or stream.

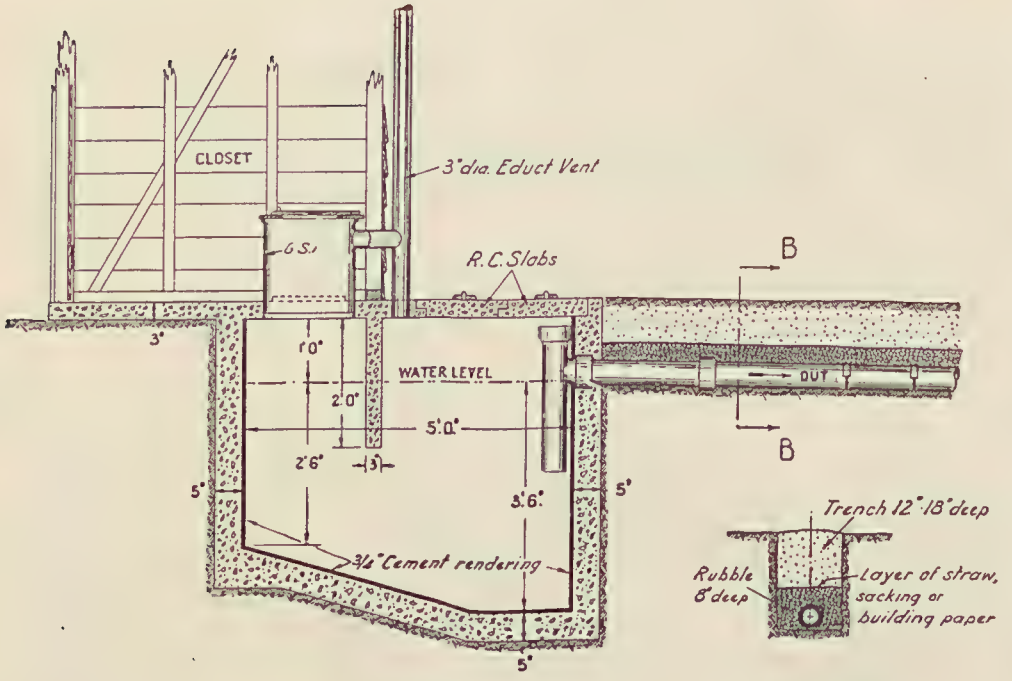
Another alternative was originated, as far as the writer is aware, by Lumsden, Roberts and Stiles, of the United States Public Health Service, and consists of a liquefying tank with one end directly under the closet seat and projecting beyond the rear of the closet, with a removable cover over the projecting portion. Water must be added to the tank from time to time, in quantity depending on the atmospheric conditions, in order to keep the contents of the tank sufficiently fluid for proper fermentation to proceed. The amount of water required was stated by the designers as equal to about half a gallon per person per week under average conditions, but it may increase to several times that amount in hot, dry weather, when evaporation is high. Each time the closet is used or a bucket of water is added, an equivalent volume of fluid is displaced through an outlet pipe, and must be absorbed in the soil as in the case of septic tank effluent.

A rather more elaborate design was published about three years later by the Kentucky State Board of Health under the name of the Kentucky Sanitary Privy, and was apparently widely used in that State for years, but was later abandoned, for reasons not given, in favour of a crude type of shallow pit closet, such as would be discouraged here.

Some years ago the question of providing sanitary accommodation at certain picnic grounds having only limited supplies of tank water arose, and the attention of the officer dealing with the problem in the Public Works Department was drawn to the Kentucky Privy. As a result he produced a modified design with four closets in pairs back-to-back, with their lengths at right angles to that of the tank, and with a urinal also discharging to the tank. As there was no regular attendant at the grounds to attend to the addition of the necessary water, the downpipe from the roof over the conveniences was led into the tank, calculations having shown that the maximum daily rainfall on the small area of roof would not be sufficient to cause any flushing out of the solid contents of the tank. This was not considered to be a thoroughly satisfactory scheme, as the period of lowest rainfall usually coincides with that of highest evaporation and greatest use of the grounds, but no better one could be devised, and the tanks being of liberal size, it appears to have worked quite satisfactorily.

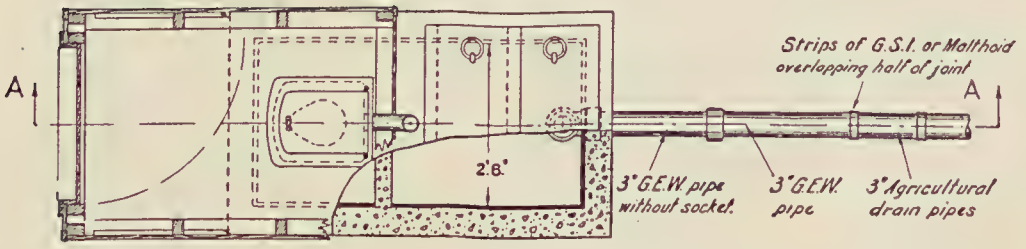
An inspection of these conveniences by an officer of the Health Department at the end of a period of heavy use in the summer of 1945–46 showed that the tanks carried little or no scum, and were not more than one-third full of sludge after about 5 years'

DEPARTMENT OF HEALTH
VICTORIA



SECTION AA

SECTION B.B.



PLAN

DIAGRAM OF SEPTIC CLOSET

use. There was some odour in the closets, but it was much less offensive than that from a pan-closet, and was similar to that from a satisfactory septic tank.

On the basis of the information set out above, the septic closet shown in the illustration has been designed. It has liberal tank capacity, and is adapted for use with a type of seat which is on the market, supplied complete with galvanized riser adapted for attachment to the floor, polished seat and cover and vent outlet. The design attempts to minimize the odour by including an educt vent from the main chamber of the tank, which is joined by the outlet from the rear of the seat cabinet.

The amount of effluent to be disposed of is very small, being equal only to the actual volume of faeces and urine, plus the few gallons of diluting water and minus the loss by evaporation. This liquid will correspond to very strong septic tank effluent and should be disposed of as shown, by means of a short length of agricultural drain laid practically level in the bottom of a trench 12 to 18 inches deep, depending on the depth of the soil, and of similar width. After laying the drain along the centre of the trench, the latter should be filled to 3 inches above the top of the pipes with any convenient coarse-grained material such as stone screenings, gravel, or ashes, screened to remove all dust and fine particles. On top of this filling there should be laid building paper, old sacking or straw to prevent the soil from filling the spaces in the coarse material, and the trench should then be filled with earth, mounding up sufficiently to allow for settling, as a furrow above the absorption drain would collect rainwater from higher ground and cause saturation of the ground below it. The paper, sacking or straw will rot, but not before the earth above it has become consolidated.

The outer opening of the vent should be covered with copper or bronze flywire to prevent access of flies and mosquitoes to the tank, and the need for closing the seat-cover to prevent access of flies to floating excreta in the first chamber should be impressed on all users, and be reinforced by a prominent notice to *Close Lid before Leaving.* The use of self-closing lids, as sometimes advocated, is undesirable, as drops of fluid often collect on the underside, whether in the case of a septic closet or a pan closet, and any self-closing arrangement causes this fouled surface to be pressed against the clothes of the user.

The inside of the galvanized iron cabinet should be well coated with hot tar before fixing, to prevent its corrosion by urine.

IMPORTANT POINTS

The septic closet as described and illustrated is legally a septic tank, and it is therefore necessary for any person who proposes to install one to make written application to the local Council, and to forward with his application plans of the device itself and the disposal drain, and also a site plan showing its position in relation to the premises served, to any well, underground tank, or other source of water supply, and to any adjacent boundary of the property.

There is likely to be a period when the tank is first put into use during which unpleasant odours are produced. Even when alkaline fermentation has become established there may be some escape of a septic tank odour when the lid is raised, in spite of the ventilators, but this odour will be far less offensive than that of a pan closet.

Cleaning out of sludge which slowly accumulates in the bottom of the tank will be necessary every few years, and must be carried out before the surface of the sludge reaches within four inches of the bottom end of the outlet pipe, otherwise sludge may be carried over and choke the absorption drain. Cleaning may be carried out by baling out the whole contents or by slowly pumping out sludge from beneath the liquid. The slope of the floor will facilitate the flow of sludge to the pump, but is not steep enough to ensure a rapid flow, and therefore after pumping for a time, a tool such as a hoe or scraper should be used with a very slow movement to work the sludge down to the low end without greatly disturbing the liquid, pumping then being resumed.

Unless otherwise directed by the proper officer of the Council, the matter removed by baling or pumping should be run into a trench about a foot deep, and long enough not to be filled to within 6 inches of the surface, and then be covered with soil.

Before starting to use a septic closet, and also after removing sludge, the tank should be filled to near outlet level with water, and when cleaning out has been done by

baling, a couple of buckets of liquid sludge—not old worked-out stuff from the bottom—should be set aside and emptied back into the tank, to re-seed it with bacteria and make the contents slightly alkaline.

A septic closet cannot be placed in the house or in direct communication with it, as is permissible with a water-closet connected by a pipe drain to a septic tank, but if properly looked after it should be free from the offences to smell and sight associated with the average pan closet, and the work of removing and disposing of the contents will be required only once in several years instead of once a week.

If any trouble from flies or mosquitoes should arise, owing to failure to close the seat-cover after use, it may be overcome by pouring in sufficient kerosene, or waste motor oil thinned with kerosene, to form a film over the surface of the liquid in the first chamber.

CONSTRUCTION

The method of construction is fairly obvious from the drawing. The hanging baffle acts also as a beam to support the rear end of the closet floor and the rear wall, and therefore must be of solid construction, while the main reinforcement in the closet floor must run lengthwise, to span across the space from the front end of the tank to the baffle.

It is suggested that the following construction be used, though the side walls may need to be strengthened in bad ground :—

Wall : 5-inch Concrete

Horizontal bars ¼-inch diameter at 8-inch centres, with additional intermediate bars in lower 2 feet.

Vertical bars ¼-inch diameter at 12-inch centres.

Floor : 5-inch Concrete

Vertical wall bars carried across floor both ways.

Closet Floor : 3-inch or 4-inch Concrete

Longitudinal bars ¼ inch at 6-inch centres, with the second bars from sides bent outwards to pass 1½ inch from sides of seat hole.

Transversely, one ¼-inch bar 1½ inch in front of seat hole, and No. 8 wire at 12-inch centres elsewhere.

Hanging Baffle : 3-inch or 4-inch Concrete

Horizontal bars ¼ inch at 8-inch centres, bent along and wired to wall bars.

Vertical, 3 rows of No. 8 wire.

Rear Cover-slabs : 3-inch Concrete

Longitudinal, 3 bars ¼-inch diameter per slab.

Transversely, 3 rows of No. 8 wire.

Lifting rings through staples bent round centre rod, or that rod brought up in a loop to concrete surface, and ring passed over rod before concreting.

General.—All reinforcement except for closet floor to be in centre of slab, and that for closet floor to be 1 inch from lower face.

Bars to be wired together at all intersections with black iron wire.

B.R.C. fabric, No. 10, may be used instead of bars as specified in all parts.

Note.—A pamphlet, "Septic Tanks for Dairy Farms," is available, free of charge, on application to the Stores Branch, Dept. of Agriculture, Melbourne, C.2.

Soil Conservation Competition

Upper Murray Region

A Soil Conservation Competition, the second to be held in this area, will be conducted in the Upper Murray Region this year by the Soil Conservation Board. The competition area embraces the Shires of Upper Murray, Towong, Bright, Oxley, Yackandandah, Beechworth, Wangaratta, Wodonga, Chiltern, Rutherglen, Yarrawonga, and that part of Omeo Shire within the Hume Catchment.

The winner of the competition will hold the Hanslow Cup for one year.

Entry forms may be obtained from the Soil Conservation Board, 175 Collins-street, Melbourne, or the abovementioned Shire Councils. There is no entry fee. Entries close on Monday, 14th February, 1949. Judging will take place during March–April, 1949.

THE VEGETABLE GARDEN

By George Hyam, Horticultural Supervisor

BRUSSELS SPROUTS

IN relation to the space they occupy, and the length of the period of use, Brussels sprouts are one of the most economical of the winter vegetables in the home garden. Less than one dozen good sprout plants will provide two or three pickings each week from April to September. They do best in cooler districts and on high elevations, but are not suitable for planting in districts north of the Divide. They flourish in all climates similar to that of Melbourne and the coastal areas generally.

Green Sprouting Broccoli—The small, prolific flower-heads make a delicious vegetable when cooked as for cauliflower.

Sprouts do best on a fairly heavy soil although they can be grown on light soils if the texture has been improved with organic manure. For a full cropping season, sprouts should be planted out as seedlings not later than February, but their seed can still be sown in seed beds for transplanting in March. Late-planted crops usually cease to yield at the same time as those planted earlier, that is, in late August or early September.

Soil preparation is the same as for cabbage and cauliflower, by digging in a liberal quantity of stable manure and raking in superphosphate at the rate of 2 to 3 oz. per square yard as a base manure before planting out. Spacing for the plants is 30 inches to 36 inches.

During growth, side-dressings of 5 : 1 : 1 superphosphate, ammonia, and potash are applied three or four times, at the rate of ½ oz. per plant (approximately one teaspoonful), starting from the time the first sprout buds are seen. Manuring for sprouts differs from that for cabbage and cauliflowers in respect to the amount of nitrogenous fertilizers applied. Too much of these tends to the formation of loose-leaved sprouts instead of tight buds. Sprouts must be regularly dusted against insects which attack crucifer crops. They are particularly subject to cabbage aphis which congregate round the tightly-packed sprouts.

Commercial growers are now using the combined DDT and gammexane dusts and getting complete control of all sprout insect pests. Arsenate of lead and nicotine combined dusts were previously used with good effect, but these require more frequent applications. For aphis, dusting should be done every fortnight or oftener.

GREEN SPROUTING BROCCOLI

Sprouting broccoli resemble sprouts inasmuch as they form a number of small cauliflower-like heads which can be picked over a period of three months or so, and consequently give another high yield for the amount of space they occupy in a small garden. Sprouting broccoli is being grown as a commercial crop to a limited extent, with a growing demand as the public begin to appreciate its delicate flavour. This is quite different from that of other crucifer leaf crops. Overseas, it is an important crop for " quick freezing ".

The plants grow rather taller than their nearest relative, the cauliflower, and the edible portions are the small flower buds which spring from the base of the cauliflower-like leaves. When about half-grown, a large centre-bud is formed and when this is picked, lateral buds are formed in quick succession. The first picking stage is reached about eight weeks after planting, and, like other crucifers, seedlings are ready to transplant from the seed beds about eight weeks after sowing. They are spaced 30 to 36 inches apart. Sprouting broccoli should be picked when the heads are in the tight-bud stage and cut off with about 3 inches of stem attached. They are then cooked in same way as cauliflower.

Frequent picking is necessary, otherwise the formation of further buds is retarded and the heads will become progressively smaller.

As with sprouts, broccoli freshly-picked is very superior to heads that have been stored for some time.

Soil preparation and manuring is the same as for sprouts and similar side-dressings should be given to keep the plants in vigorous growth.

The same regular dustings or sprayings are necessary to check the insects which affect all crucifers.

The season for green-sprouting broccoli is rather later than that of sprouts, and January or February is a good month to sow the seed. Sowings can continue until April and again in October and November for an early crop. Sprouting broccoli are less particular as to soil than sprouts, and they can be successfully grown in all districts, but, in the northern irrigation areas, plantings should be confined to February–March sowings. About eight to twelve plants are sufficient for household use.

There are other types of broccoli, some of which grow single white heads hardly distinguishable from cauliflower; others produce small white heads with "curds" like small cauliflowers, but the green-sprouting broccoli is superior in flavour to these other types.

OTHER JANUARY WORK

All summer vegetables can still be planted in January for late crops in all districts where frosts are not expected before the end of May, and, in many districts, even a late planting of tomato seedlings may be made.

Where it is possible to obtain sprouted seed-sets, a late crop of potatoes can be planted to supply "new potatoes" in early autumn.

Carrots, parsnips, and beets can still be sown in southern and midland districts. In the north, it is better to defer the sowing of these vegetables until late February or March.

Swede turnips can be sown in cool high-elevation districts. Most onion crops will be ready for lifting at the end of the month, and the beds they occupied should be manured and dug over preparatory to planting out winter crops next month.

Beds containing old crops of beans should likewise be prepared for leaf vegetables or for late lettuce.

The first crop of leeks can be planted out as seedlings in late January and celery seedlings can also be planted. As these are relatively slow growing, salad crops could be planted between the rows if a little extra spacing is allowed. Cultivation near growing crops should be very shallow during the hot weather, but a light stirring with a dutch hoe prior to watering will allow better penetration of water from a sprinkler. A similar stirring of the top soil 24 hours after watering will prevent the heavy types of soil from caking or cracking.

A light mulching of all vegetable beds assists the retention of moisture as well as keeping surface roots cooler, and it does away with the necessity of these frequent cultivations. Mulching over newly-sown root crops prevents the scorching of the germinating seeds, but this should not exceed an inch in thickness unless the material is somewhat open textured, as, for instance, straw, which makes a good summer mulch for all plants.

Semi-rotted material makes the best mulch and it will be in good condition for turning under in the autumn. The top soil should be loosened before applying a mulch. Seed-beds containing summer vegetables should be kept moist, but overwatering tends to make sappy plants that may be affected by heat when planted out. As planting time approaches, cut down the waterings as much as possible so as to harden them off.

THE FLOWER GARDEN

By T. H. Kneen, B.Agr.Sc., Principal,
School of Horticulture and Primary Agriculture, Burnley Gardens.

An attractive bed of daffodils. [Photo from "*Blom's Bulbs*".

DAFFODILS (NARCISSUS)

IN last month's issue, the distinctive features of four of the eleven main divisions of Narcissus were discussed. By far the most satisfactory way for the amateur to become familiar with the various kinds is to ask a reliable bulb specialist to supply him with a representative collection including, not only the species on which the convential classification is based, but also some of the hybrids which are considered to fall within these groups. It may not be possible to secure a complete collection at once, but when a start has been made, it is not hard to make additions. Various books such as McFarland's "Bulbs in Colour" give an adequate description, profusely illustrated, of the various types. It is only by handling living specimens that one can really become familiar with the many types of Narcissus—triandrus hybrids, tazetta hybrids, and so on.

The rate of reproduction of daffodils is slow, but most varieties and species reproduce readily by producing offsets which will flower in the second year. In this way it is practicable to build up a good stock from a small beginning. The raising of seedlings as a means of increasing stock does not offer an easy way out since it may take four to six years to get a bloom from seed. Furthermore, seedlings from hybrid varieties particularly, do not come "true", and the results are likely to be disappointing. On the other hand, many fine seedlings are raised in this way.

Should the amateur develop a desire to raise a new hybrid variety there are a few points which he should consider in the interests of the daffodil of the future. Beautiful as they are, there is no doubt that many of our modern hybrid varieties of daffodil, and indeed of many other kinds of plants, lack those qualities of endurance and disease resistance which are necessary for garden work. We have all noticed old varieties of daffodils flowering year after year in old gardens without any care or attention. How many of our modern hybrids will be seen persisting likewise a generation from now?

Probably in future the breeding of new varieties will pass to fully-equipped plant-breeding stations, but, in the meantime, the amateur breeder should study the disease resistance and reproductive capacity of new hybrids under field conditions, and not only the points which are important on the show bench. In Australia, we are fortunate in possessing many fine breeders of the daffodil who are preserving the "King Alfred" standards of endurance and disease resistance.

Since many modern hybrids lack disease resistance it becomes desirable to breed them with older, resistant types. Alternatively, the older types can be taken and improved, seeking to reach the standard of the modern hybrid in colour and form while yet retaining the factor of resistance to disease. In both lines of approach it is necessary to test hybrids under exacting field conditions before building up stocks. It is well known that *N. poeticus* and *N. tazetta* exhibit so much resistance to basal rot and virus diseases as to be regarded as immune. Such species should enter into breeding programmes if a truly worthwhile hybrid is to be raised.

Cultural Hints

Daffodils require a well-drained soil, and the ideal conditions for flower production are provided by good strong volcanic soils. In gardens, an open position shaded from the hottest sun is satisfactory. As a general rule the paler daffodils can be given more shade.

The normal planting time is March, but planting may extend from February to May. Average-sized bulbs may be planted 4 to 5 inches deep in medium soils, deeper in light soils, and rather shallower in the heaviest soils. Beds or clumps of daffodils should be lifted and divided after four or five years, as the plant food becomes exhausted. The vigour of beds may be maintained by giving a dressing of old manure or 1 oz. per square yard of bone dust in autumn. If the bulbs need forcing they can be watered with a weak sulphate of ammonia solution. A thorough watering of a bed in February or March will start the bulbs into growth.

When planting, the soil should be well worked to a depth of a foot or more and given a dressing of market garden manure, 3 oz. to the square yard. This dressing can be repeated and lightly forked in when the foliage shows through.

Book Review

Field Crop Abstracts

(This journal may be ordered from C.A.B. Central Sales Branch, Penglais, Aberystwyth, Wales. Annual subscription 35s. Sterling, less 20 per cent. for orders placed direct.)

This new abstracting journal has appeared as a result of a recommendation of the 1946 Review Conference of the Commonwealth Agricultural Bureaux, whereby the information centre formerly known as the Commonwealth Bureau of Pastures and Forage Crops became the Commonwealth Bureau of Pastures and Field Crops.

For the first time, abstracts of world literature on the cultivation and agricultural botany of all field crops which are grown in rotation are brought together under one cover. General sections on such subjects as land utilization and management, farming systems, machinery and equipment and the field control of weeds, diseases and pests, are followed by sections on cereals, legumes, oil and fibre crops, and root crops. Further sections deal with crop botany, physiology and biochemistry, environmental studies, taxonomy, and book reviews. In those sections of the journal containing abstracts on specific crops, each crop is dealt with under headings such as agronomy, crop geography, economics of production, adaptation and variety trials, &c.

The journal has six issues per year, appearing in January, March, May, July, September, and November, the first five containing author indexes, and the sixth being in the form of a comprehensive index, containing author, subject, crop, and geographic indexes.

PROFESSIONAL PAPER

LOWER LEAF SCORCH OF FLAX

By C. R. Millikan, M.Agr.Sc., Senior Plant Pathologist

The first and second portions of this paper appeared in our November and December, 1948, issues

PLANT ANALYSES

In addition to the analyses of experimental plants given above, samples of comparable healthy and diseased plants respectively grown in the field were submitted to the Agricultural Research Chemist for analysis. Each pair of samples consisted of apparently healthy and diseased plants collected from the same crop. Samples of seed obtained from two crops severely affected with lower leaf scorch, and from eight healthy crops in various parts of Victoria were also analysed.

The dates of sampling given show that the plants were usually collected between the end of September and the middle of October. The approximate heights of the plants at this time were :—Apparently healthy, 12 to 18 inches; diseased, 6 to 12 inches; the height depending on the severity of the symptoms. No flowering had occurred in any of the samples. The Lake Bolac samples collected on 25th August, 1945, were six weeks old and approximately 3 inches tall. As the disease had just appeared, there was little difference in height between diseased and healthy plants. The samples taken from the same crops on 4th October, 1945, were from the same sections of the crops as the earlier samples.

Dry weights of the 1946 samples were as follows :—

	Dryweight per 100 Plants.	
	Gisborne.	Westmere.
	grams.	grams.
Healthy	18·10	4·64
Diseased	3·82	1·78

From the results of the analyses set out in Table 7, it is seen that the concentrations of most mineral constituents are generally somewhat higher in diseased plants than in healthy plants. This was doubtless related to some extent to the poorer growth of the diseased plants as compared with the healthy plants.

The most striking feature was the increase which occurred in the manganese content in diseased plants. This was a constant feature in all pairs of samples except one in which this element was determined. In the one exception the manganese concentration was very high in both healthy and diseased plants. In most cases the increase in the manganese concentration of the diseased plants was several times the normal concentration and was relatively much greater than the increases of most other constituents. This supports the results of water cultures (Millikan 1948) and of the pot and field experiments described above which showed that symptoms of lower leaf scorch disease could be produced by application of an excess of manganese.

The analyses in Tables 1 and 3 also show a similar relationship between the manganese concentration and the lower leaf scorch status of the plants.

The manganese concentration in the plant decreases rapidly with age (Leidreiter 1910, Hale et al 1946). The youngest plants analysed (i.e., those in Table 3 (seven weeks old), the 1946 Westmere samples (eight weeks old, see Table 7), and the 1947 Streatham plants (eight weeks old), (the analyses of which are included in the discussion of the effect of molybdenum) were found to be much higher in manganese than the older plants from similar soils (Tables 1 and 7).

TABLE 7.—RESULTS OF ANALYSES† (ON DRY BASIS) OF PAIRS OF SAMPLES—ONE OF APPARENTLY HEALTHY FLAX, AND ONE OF PLANTS SHOWING LOWER LEAF SCORCH SYMPTOMS, OBTAINED FROM DIFFERENT FLAX CROPS GROWN IN VICTORIA IN THE SEASONS 1942, 1944, 1945, AND 1946, RESPECTIVELY.

Locality and Date of Sampling.	Disease Status.	Constituent. Nitrogen. %	Crude Ash. %	Silica. %	Silica Free Ash. %	Lime (CaO). %	Magnesia (MgO). %	Potash (K_2O). %	Phosphoric Acid (P_2O_5). %	Iron (Fe). %	Manganese (Mn). p.p.m.	Copper (Cu). p.p.m.	Boron. p.p.m.	Zinc (Zn). p.p.m.	Aluminium Oxide (Al_2O_3). p.p.m.
1942.															
Nilma North—30th September, 1942	H	..	9·91	..	..	1·11	1·02	0·22	..	..	..	..	..	..	..
	D	..	10·58	..	..	1·04	1·09	0·33	..	..	..	..	..	..	..
1944.															
Beeac 1—16th October, 1944	H	2·99	9·36	0·71	8·65	0·89	0·43	3·11	0·35	..	13	3	33	84	..
	D	4·69	13·63	1·70	11·93	1·10	0·74	4·45	0·58	..	46	7	80	129	..
Beeac 2—16th October, 1944	H	3·22	9·35	0·49	8·86	0·75	0·39	3·80	0·31	..	5	15	57	129	..
	D	4·72	13·36	2·01	11·35	1·32	0·54	4·07	0·55	..	46	6	24	186	..
Gisborne—12th October, 1944	H	3·27	7·64	0·62	7·02	0·78	0·45	1·51	0·32	..	14	8	36	129	..
	D	4·88	12·08	2·25	9·73	1·10	0·65	2·23	0·49	..	22	3	12	119	..
1945.															
Lake Bolac 1—28th August, 1945	H	..	..	..	..	..	..	..	1·07	..	..	..	..	33	..
	D	..	..	..	..	..	..	..	1·07	..	..	..	..	82	..
4th October, 1945	H	..	10·26	1·17	9·09	..	..	..	0·43	0·038	32	..	..	36	250
	D	..	13·27	2·53	10·74	..	..	..	0·66	0·069	75	..	..	27	610
Lake Bolac 2—25th August, 1945	H	..	..	..	..	..	..	..	0·69	..	..	..	..	47	..
	D	..	..	..	..	..	..	..	1·19	..	..	..	..	64	..
4th October, 1945	H	..	10·85	1·45	9·40	..	..	..	0·46	0·051	37	..	..	34	500
	D	..	13·52	2·40	11·12	..	..	..	0·82	0·082	53	..	..	27	860
Lake Bolac 3—4th October, 1945	H	..	9·50	0·56	8·94	..	..	..	0·46	0·027	39	..	..	27	130
	D	..	11·45	1·45	10·00	..	..	..	0·68	0·069	112	..	..	26	940
Westmere—4th October, 1945	H	..	12·41	1·75	10·66	..	..	..	0·60	0·061	44	..	..	54	660
	D	..	13·93	2·54	11·39	..	..	..	0·87	0·065	148	..	..	27	500
1946*.															
Gisborne—9th October, 1946..	H	..	..	..	..	..	..	..	0·96	0·043	159	..	..	39	..
	D	..	..	..	..	..	..	..	1·68	0·170	169	..	..	85	..
Westmere—6th September, 1946	H	..	..	..	..	..	..	..	1·69	0·065	621	..	..	36	..
	D	..	..	..	..	..	..	..	2·27	0·130	547	..	..	63	..

H=Apparently healthy. D=Affected with lower leaf scorch.

* Molybdenum determinations were made on the 1946 samples. The amount present was reported as "nil" when determined by two recognized colorimetric methods for molybdenum in trace quantity. If present at all, it was in such minute amount that it could only be determined spectographically. The dry weights of the 1946 samples are given in the text.

† These analyses were all performed in State Laboratories under the general direction of Mr. W. R. Jewell.

TABLE 8.—RESULTS OF ANALYSES (ON DRY BASIS) OF CONCURRENT FLAX SEED SAMPLES FROM TWO CROPS SHOWING LOWER LEAF SCORCH SYMPTOMS AND EIGHT HEALTHY CROPS, GROWN IN VARIOUS DISTRICTS OF VICTORIA IN 1945.

Locality.	Lower Leaf Scorch Status of Crop.	Zinc (Zn).	Manganese (Mn).
		p.p.m.	p.p.m.
Lake Bolac ..	Diseased ..	98	106
Westmere ..	Diseased ..	76	70
Portarlington ..	Healthy ..	80	18
Drysdale	Healthy ..	85	25
Lismore	Healthy ..	45	24
Mt. Bute	Healthy ..	76	21
Neerim	Healthy ..	38	42
Buln Buln ..	Healthy ..	32	12
Leongatha ..	Healthy ..	91	28
Winchelsea ..	Healthy ..	61	24

The manganese contents of the two seed samples from crops showing lower leaf scorch symptoms (Table 8) were greater than that of any of the seed samples from healthy crops.

The relationship of molybdenum deficiency to the disease as outlined in the literature citations above, and further shown by the results of experiments in Tables 4, 5, and 6 (Figs. 4 and 7), indicates that the Mn/Mo ratio in the plant is of considerable importance. No molybdenum was detected in the 1946 samples (Table 7), but, in the 1947 Streatham samples (see section above on molybdenum), the Mn/Mo ratio was much lower in the healthy than in the diseased plants.

In some samples very high zinc concentrations (up to 186 parts per million) were revealed. By way of comparison Piper and Walkley (1943) give the concentration of zinc in normal flax plants, at a comparable stage in development to the above samples, as approximately 20 parts per million. However, the lower leaf scorch status of the samples could not be correlated in all instances with an increased zinc concentration either in the plant (Tables 1, 3, and 7) or seed (Table 8).

The total iron content was consistently higher in diseased plants, even though the plants were slightly chlorotic, indicating that much of the iron in such plants had been rendered unavailable, probably in the form of insoluble iron-phosphorus-organic complexes (Somers and Shive (1942), Leeper (1944)). In this regard Millikan (1947A) and other workers have also shown that chlorotic leaves may actually contain a higher iron content than normal. This unavailability of the iron is in accord with the results of the water culture experiments with excess manganese and other elements described by Millikan (1948). The fact that diseased plants may have a very high iron content is also strikingly revealed in the analyses shown in Tables 1 and 3.

SUMMARY

A disease of flax designated "lower leaf scorch" has occurred in Victoria in flax grown on highly acid soils (pH 4.5 to 5·2 approximately). The areas concerned have been generally either virgin ground or ground which had been under ley conditions for many years before being broken up and sown to flax.

The symptoms of the disease are described.

The effects of various soil treatments on the incidence of lower leaf scorch were examined in pot and field experiments. The disease was found to be aggravated by the application of either manganese sulphate, sulphur or zinc sulphate to the soil, or by steam sterilization. On the other hand, sodium molybdate, ammonium molybdate, or lime applications significantly reduced the percentages of flax plants affected with lower leaf scorch. A reduction in the number of lower leaf scorch affected plants also occurred in portions of two commercial flax crops which were treated with small amounts of ammonium molybdate at sowing time.

The observed effect of superphosphate in reducing the severity of the disease in natural soil, was probably due to the presence of a significant amount of molybdenum impurity. However, when applied in conjunction with high levels of manganese application, superphosphate significantly increased the severity of lower leaf scorch.

Small applications of ammonium molybdate significantly reduced the toxic effects in flax plants resulting from heavy dressings of manganese sulphate to highly acid soils. Flax was found to be much more sensitive than oats to an excess of manganese in the substrate.

It was possible to correlate changes in the incidence of the disease directly with the effects of the treatments on the manganese concentrations of the plants, but not with the zinc concentrations, except in those cases where zinc sulphate had been applied to the soil.

In the field experiments, plants treated with sulphur plus superphosphate were much more susceptible to frost injury than were those of any other treatment.

Analyses of both plant and seed samples collected in the field revealed that the most striking feature of the disease was its association with an increase in the manganese concentration, which increase was proportionally much greater than the increases recorded for certain other ash constituents. The manganese-molybdenum ratio was lower in healthy plants than in diseased plants.

It is concluded that lower leaf scorch is due to the combined effects of manganese toxicity and molybdenum deficiency in the affected plants, induced by highly acid soil conditions. The existence of a manganese-molybdenum antagonism in the plant is confirmed.

ACKNOWLEDGMENT

Valuable assistance was given by officers of the Flax Production Committee of the Department of Supply and Shipping, and, in particular, by Mr. A. A. Lee in the conduct of the field experiments, and the collection of soils for the pot experiments described in this paper.

The ash analyses set out in this paper were all performed in the State Laboratories under the direction of Mr. W. R. Jewell, Agricultural Research Chemist.

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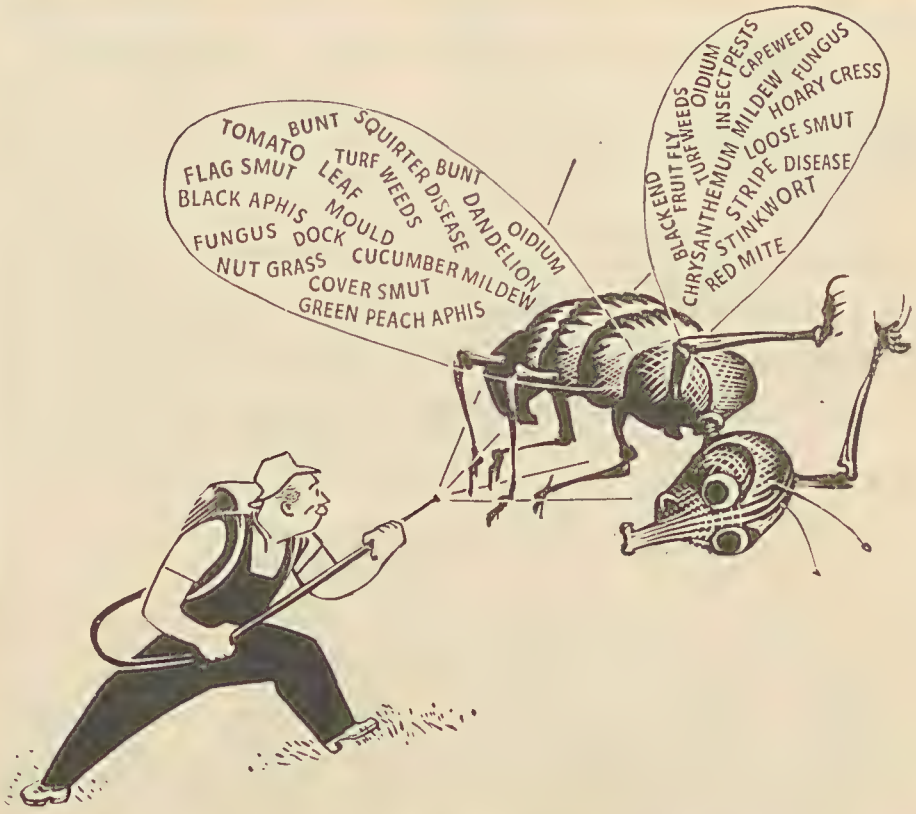

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BOOKS REVIEWED

New and promising varieties recently described in the Literature (7th Issue)

Commonwealth Bureau of Plant Breeding and Genetics, 1948, pp. 44. Obtainable from technical book shops or from the C.A.B. Liaison Officer, 314 Albert-street, East Melbourne, C.2. Price 3s. 2d.

The publication presents in tabular form information as to agronomic characteristics, disease resistance and general adaptation of new and promising varieties of cultivated plants which have been recently described in the literature.

Wheat, oats, barley, rye, maize, sorghum, rice, herbage grasses and legumes, root, vegetable, fibre plants, sugar cane, tobacco, hops, pepper and fruit crops are included.

The material is based almost entirely on records in vols. 15 to 17 of Plant Breeding Abstracts; references are quoted, together with the names and addresses of the institutions and organizations from which further information may be obtained.

Australia's contributions are restricted to several wheat varieties with one flax and one cotton entry.

[H. C. TRUMBLE.]

Seed Production of European Vegetables in the Tropics by A. G. G. Hill, Technical Communication No. 19, Commonwealth Bureau of Horticulture and Plantation Crops, 1948, pp. 28. Obtainable from C.A.B. Liaison Officer, 314 Albert-street, East Melbourne, C.2. Price 2s. 6d.

When normal sources of vegetable seeds were cut off during the war a scheme was launched in East Africa to meet local needs and to supply the United Kingdom and other Allied Countries. This was done in 1942, and, in 1944, the Bureau of Horticulture and Plantation Crops sent a questionnaire to many tropical regions to collect all the available information on seed growing. The replies are summarized in this publication. The considerable amount of information collected is presented in readable form, and useful lists of vegetable varieties are given. The replies show that successful seed production of certain vegetables is possible in the tropics, and that seeds can be produced more quickly than under temperate climatic conditions.

FERTILIZERS FOR 1949

Registered Brands and Unit Values

By W. R. JEWELL, M.Sc., Chemist for Agriculture

THE list of registered fertilizers for 1949 showing brand, analysis, price and manufacturer, is reproduced in this issue, together with unit values, and should be retained for future reference by all users of fertilizers.

The main provisions of the Fertilizers Act should, by now, be well known to all interested parties, but cases still occur where farmers purchase fertilizer because of extravagant claims made by the salesman without ascertaining whether the bags are properly labelled and without checking the accuracy of the claims made.

With the Fertilizers Act for his protection any farmer has only himself to blame if, after making such a purchase, he finds he has been taken down. Fortunately such cases are rare, but they would never occur if the farmer consulted the list of registered fertilizers, saw that each bag was properly labelled with the brand, analysis, and weight, insisted on receiving an invoice certificate in the terms required by the Act and, where any doubt existed at all, first inquired of the Chemist for Agriculture. Be sure before you purchase is very sound advice.

The list for 1949 does not show many changes from the previous list, but a few points are worthy of notice. Superphosphate mixed with copper, zinc, &c. is registered for the first time and is available for the limited areas known to be deficient in one or more of these trace elements.

The list of unit values, based on analyses and prices of fertilizers, shows the calculated value of each 1 per cent. of the particular ingredient per ton of fertilizer. The approximate commercial value of any fertilizer can therefore be determined by multiplying the percentage of each ingredient by its appropriate unit value, and adding together the figures so obtained; a figure to cover cost of mixing must be added in the case of mixed fertilizers. The purchaser is thus able to compare the value of a particular fertilizer with the price charged and to compare the relative value of a number of brands of the same fertilizer.

The prices for blood and bone and other fertilizers of animal origin will be found to differ more widely than usual. This is because certain manufacturers have been allowed increases by Prices Control, while others have been satisfied to operate on old prices; this increases the difficulty in determining a fair unit value for organic nitrogen, which is up 1s. on last year. Fertilizers of organic origin are still in short supply and farmers should see that they are not overcharged.

The unit value for water soluble phosphoric acid is based on the price of superphosphate to the farmer, that is, after deduction of the Government subsidy of £2 5s. per ton. Without this subsidy, provided by the taxpayer, superphosphate would be that much dearer to the farmer and the unit value would rise to a figure which was more truly representative of the actual cost. This year, for the first time since the war, superphosphate is solely of the high 22 per cent. quality.

Practically the only potash available is that produced locally, for which a relatively large increase in price has been approved by Prices Control. One effect of this has been to increase the price of all mixed fertilizers containing potash. The prices shown are after deducting the Government subsidy on the amount of superphosphate in them.

It should be noted that prices shown in the list are for ton lots on rails nearest point of manufacture. Freight to destination must therefore be added and, for small lots of a few bags, the price will be somewhat higher. The purchaser should ensure that he is not charged higher prices than those registered, and any cases of over-charging should be reported.

REGISTERED FERTILIZERS

ANALYSES AND UNIT VALUES

Fertilizers Act 1928 (No. 3680).

UNIT VALUES FOR THE YEAR 1949.

	£	s.	d.
Nitrogen, organic, as Blood; Blood and Bone; Blood, Bone, and Flesh; and Bone ..	1	1	0
„ as Nitrate	1	3	2
„ as Ammonia	0	18	0
Phosphoric Acid—			
as Water Soluble in Superphosphate and Mixed and Complete Fertilizers containing Superphosphate	0	6	3
as Citrate Soluble	0	5	6
as Citrate Insoluble—			
in Superphosphate and Mixed and Complete Fertilizers containing superphosphate, except mixtures of super. and bone or blood and bone	0	2	0
in other Fertilizers	0	5	0
Potash—			
as Sulphate	0	10	7
as Chloride	0	8	0

Melbourne, 2nd December, 1948.

W. R. JEWELL, M.Sc., F.R.I.C.,
Chemist for Agriculture.

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE FERTILIZERS ACT 1928 (No. 3680) FOR THE YEAR 1949.

Description of Fertilizer.	Brand.	Nitrogen.						Phosphoric Acid.				Potash as Unspecified.	Price asked per ton.*	Where Obtainable.
		As Nitrate.	As Ammonia.	As Blood.	As Blood and Bone.	As Blood, Bone, and Flesh.	Total.	As Water Soluble.	As Citrate Soluble.	As Citrate Insoluble.	Total.			
		%	%	%	%	%	%	%	%	%	%	%	£ s. d.	
Nitrogenous—Readily Available.														
Nitrate of Soda	Sickle in diamond	16·00	..	..	..	..	16·00	..	..	..	..	..	18 10 0	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne
„ „	Pivot ..	16·00	..	..	..	..	16·00	..	..	..	..	..	18 10 0	The Phosphate Co-operative Co. of Aust. Ltd., 447 Little Collins-st., Melbourne
Sulphate of Ammonia	M.G. Co. in diamond	..	20·59	..	..	..	20·59	..	..	..	..	..	18 10 0	The Metropolitan Gas Co., 196 Flinders-st., Melbourne
„ „	Pivot ..	..	20·60	..	..	..	20·60	..	..	..	..	..	18 10 0	The Phosphate Co-operative Co. of Aust. Ltd., 447 Little Collins-st., Melbourne
„ „	Sickle in diamond	..	20·60	..	..	..	20·60	..	..	..	..	..	18 10 0	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne
„ „	Icianz ..	..	20·60	..	..	..	20·60	..	..	..	..	..	18 10 0	Imperial Chemical Industries of Aust. and N.Z. Ltd., 380 Collins-st., Melbourne
Moderately Available.														
Dried Blood ..	T.B. & S. in diamond—Brooklyn	..	..	12·00	..	..	12·00	..	..	..	..	..	13 5 6	Thos. Borthwick and Sons (A'asia) Ltd., 84 William-st., Melbourne
„ „ ..	T.B. & S. in diamond—Portland	..	..	12·00	..	..	12·00	..	..	..	..	..	13 4 8	Thomas Borthwick and Sons (A'asia) Ltd., 84 William-st., Melbourne
„ „ ..	M.C.C. in diamond	..	..	12·00	..	..	12·00	..	..	..	..	..	14 6 0	Melbourne City Council, Town Hall, Melbourne
„ „ ..	Champion ..	..	..	13·00	..	..	13·00	..	..	..	..	..	13 0 0	Sims Cooper (Freezing Works) Pty. Ltd., 31 Queen-st., Melbourne
Blood Manure	Dandy ..	..	..	10·56	..	..	10·56	..	..	..	..	..	10 10 0	Gippsland Co-op. Bacon Curing Co. Ltd., Dandenong

* F.o.r. at Melbourne or Railway Station nearest place of manufacture.

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE FERTILIZERS ACT 1928 (No. 3680) FOR THE YEAR 1949—*continued.*

Description of Fertilizer.	Brand.	Nitrogen.						Phosphoric Acid.				Potash as Unspecified.	Price asked per ton.*			Where Obtainable.
		As Nitrate.	As Ammonia.	As Blood.	As Blood and Bone.	As Blood, Bone, and Flesh.	Total.	As Water Soluble.	As Citrate Soluble.	As Citrate Insoluble.	Total.		£	s.	d.	
		%	%	%	%	%	%	%	%	%	%	%				
Nitrogenous *Moderately Available* —continued.																
Blood Manure ..	Vima ..	..	..	11·00	..	..	11·00	..	..	..	..	..	11	0	0	Victorian Inland Meat Authority, 54 Market-st., Melbourne
„ „	Pentagon ..	..	..	8·13	..	..	8·13	..	2·07	1·13	3·20	..	9	11	0	Mulgrave By-Products Co., North-rd., East Oakleigh
Slowly Available.																
Castor Meal ..	Alba ..	..	..	..	..	..	4·50 (as castor meal)	..	..	2·25	2·25	·75	4	5	0	Lycett Proprietary Ltd., Normanby-rd., Montague
Rape Seed Meal	Alba ..	..	..	..	..	..	5·50 (as rape seed meal)	..	..	1·75	1·75	1·50	5	5	0	„ „ „
Phosphatic— Readily Available.																
Super-phosphate†— 22 per cent...	Sickle in diamond	..	..	..	..	..	..	20·50	0·50	1·00	22·00	..	6	13	0	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne
„ „ ..	Pivot ..	..	..	..	..	..	..	20·50	0·50	1·00	22·00	..	6	13	0	Phosphate Co-operative Co. of Aust. Ltd., 447 Little Collins-st., Melbourne
„ „ ..	Cresco ..	..	..	..	..	..	..	20·50	0·50	1·00	22·00	..	6	13	0	Cresco Fertilizers Ltd., Geelong
Superphosphate plus Trace Elements.																
Super. with Zinc‡	Sickle in diamond	..	..	..	..	..	..	19·00	0·50	0·90	20·40	..	8	5	6	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne
„ „ „†	Cresco ..	..	..	..	..	..	..	19·70	0·50	1·00	21·20	..	8	5	6	Cresco Fertilizers Ltd., Geelong
Super. with copper§	Sickle in diamond	..	..	..	..	..	..	19·70	0·50	1·00	21·20	..	9	10	0	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne
„ „ „	Cresco ..	..	..	..	..	..	..	19·70	0·50	1·00	21·20	..	9	10	0	Cresco Fertilizers Ltd., Geelong
Super. with Copper and Cobalt‖	Cresco ..	..	..	..	..	..	..	19·70	0·50	1·00	21·20	..	10	4	6	„ „ „
Phosphatic— Moderately Available.																
Basic Super. reverted	Sickle in diamond	..	..	..	..	..	..	..	15·50	3·20	18·70	..	7	7	3	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne
„ „	Pivot ..	..	..	..	..	..	..	..	15·50	3·00	18·50	..	7	7	3	The Phosphate Co-operative Co. of Aust. Ltd., 447 Little Collins-st., Melbourne
Potassic— Readily Available																
Sulphate of Potash	Pivot ..	..	..	..	..	..	..	..	..	..	..	48·50 (as sulphate	26	5	0	The Phosphate Co-operative Co. of Aust. Ltd., 447 Little Collins-st., Melbourne
„ „	Sickle in diamond (90%)	..	..	..	..	..	..	..	..	..	..	48·50 (as sulphate	22	10	0	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne
Muriate of Potash	Sickle in diamond (80%)	..	..	..	..	..	..	..	..	..	..	50·00 (as chloride)	20	0	0	„ „ „
Potash Salts (mainly sulphate)	A.P.C. ..	..	..	..	..	..	..	..	..	..	..	45·00 (unspecified)	26	5	0	Australian Portland Cement Pty. Ltd., 422 Collins-st., Melbourne

* F.o.r. at Melbourne or Railway Station nearest place of manufacture. † The price per ton of superphosphate as shown is after deduction of Government subsidy of £2 5s. per ton. § Contains 7 lb. zinc sulphate (anhydrous) per 187-lb. bag. ‡ Contains 14 lb. zinc sulphate (hydrated) per 187-lb. bag. ‖ Contains 7 lb. copper sulphate (hydrated) per 187-lb. bag.

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE FERTILIZERS ACT 1928 (No. 3680) FOR THE YEAR 1949—*continued.*

Description of Fertilizer.	Brand.	Nitrogen.						Phosphoric Acid.				Potash as Unspecified.	Price asked per ton.*	Where Obtainable.
		As Nitrate.	As Ammonia.	As Blood.	As Blood and Bone.	As Blood, Bone, and Flesh.	Total.	As Water Soluble.	As Citrate Soluble.	As Citrate Insoluble.	Total.			
		%	%	%	%	%	%	%	%	%	%	%	£ s. d.	
MIXED FERTILIZERS.														
Containing Nitrogen and Phosphoric Acid—														
Readily Available.														
Super. and Ammonia	Cresco (3 and 1)	..	5·00	..	..	..	5·00	15·40	0·30	0·80	16·50	..	10 12 9	Cresco Fertilizers Ltd., Geelong
,, ,,	Cresco (6 and 1)	..	2·90	..	..	..	2·90	17·50	0·40	0·90	18·80	..	9 5 3	,, ,, ,,
,, ,,	Cresco (2 and 1)	..	6·87	..	..	..	6·87	13·66	0·34	0·66	14·66	..	11 13 6	,, ,, ,,
,, ,,	Pivot II. (3 and 1)	..	5·00	..	..	..	5·00	15·30	0·30	0·80	16·40	..	10 12 9	The Phosphate Co-operative Co. of Aust. Ltd., 447 Little Collins-st., Melbourne
,, ,,	Pivot I. (6 and 1)	..	2·90	..	..	..	2·90	17·40	0·40	0·80	18·60	..	9 5 2	,, ,, ,,
,, ,,	Pivot II. (*a*) (2 and 1)	..	6·80	..	..	..	6·80	13·60	0·30	0·60	14·50	..	11 13 6	,, ,, ,,
,, ,,	Sickle in diamond (3 and 1)	..	5·00	..	..	..	5·00	15·40	0·40	0·70	16·50	..	10 12 9	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne
,, ,,	Sickle in diamond (6 and 1)	..	2·90	..	..	..	2·90	17·60	0·40	0·90	18·90	..	9 5 3	,, ,, ,,
,, ,,	Sickle in diamond (2 and 1)	..	6·90	..	..	..	6·90	13·70	0·30	0·70	14·70	..	11 13 6	,, ,, ,,
,, ,,	Sickle in diamond (1 and 1)	..	10·30	..	..	..	10·30	10·25	0·25	0·50	11·00	..	14 0 0	,, ,, ,,
Nitro Superphosphate	Sickle in diamond	..	1.50	..	..	5·0	2·000	17·60	0·90	1·30	19·80	..	9 5 6	,, ,, ,,
Moderately Available.														
Blood, Bone, and Super.	Sickle in diamond	..	..	..	..	2·50	2·50	13·60	2·70	3·10	19·40	..	9 18 6	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne
Bone and Super.	Sickle in diamond, No. 1	..	..	..	..	2·00	2·00	12·30	3·00	5·30	20·60	..	9 19 6	,, ,, ,,
Super. and Bone	Sickle in diamond, No. 2	..	..	..	..	1·00	1·00	17·70	1·30	1·90	20·90	..	8 19 0	,, ,, ,,
Containing Phosphoric Acid and Potash—														
Readily Available.														
Super and Potash	Sickle in diamond	..	..	..	..	..	..	15·40	0·40	0·70	16·50	11·20 (unspecified)	13 14 0	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne
,, ,,	Pivot 9 (3 and 1)	..	..	..	..	..	..	15·40	0·30	0·80	16·50	12·10 (unspecified)	13 14 0	The Phosphate Co-operative Co. of Aust. Ltd., 447 Little Collins-st., Melbourne
,, ,,	Cresco (3 and 1)	..	..	..	..	..	..	15·40	0·30	0·80	16·50	11·25 (unspecified)	13 14 0	Cresco Fertilizers Ltd., Geelong

		As Flesh, Hoof, and Treated Leather.
		%

* F.o.r. at Melbourne or Railway Station nearest place of manufacture.

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE FERTILIZERS ACT 1928 (No. 3680) FOR THE YEAR 1949—*continued.*

Description of Fertilizer.	Brand.	Nitrogen.						Phosphoric Acid.				Potash as Unspecified.	Price asked per ton.*	Where Obtainable.
		As Nitrate.	As Ammonia.	As Blood.	As Blood and Bone.	As Blood, Bone, and Flesh.	Total.	As Water Soluble.	As Citrate Soluble.	As Citrate Insoluble.	Total.			
MIXED FERTILIZERS—*contd.*		%	%	%	%	%	%	%	%	%	%	%	£ s. d.	
Nitrogen—Slowly Available.														
Flesh, Hoof, and Treated Leather with Bone	Pannifex (G)	4·75	..	1·50 (as bone)	..	..	6·25	..	7·25	6·25	13·50	..	12 3 0	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
ANIMAL FERTILIZERS.														
Containing Nitrogen and Phosphoric Acid—Moderately Available														
Blood and Bone	J. A. Dundas	..	..	..	..	4·50	4·50	..	7·14	13·61	20·75	..	10 3 9	J. A. Dundas Pty. Ltd., Dynon-rd., Footscray
,, ,,	Corio ..	..	..	..	4·50	..	4·50	..	5·00	10·00	15·00	..	8 6 0	The Corio Trading Co. Pty. Ltd. 164 Moorabool-st., Geelong
,, ,,	Fitzroy Special	..	..	..	..	5·00	5·00	..	13·00	5·00	18·00	..	9 10 0	W. Angliss and Co. (Aust.) Pty. Ltd., 42 Bourke-st., Melbourne
,, ,,	Murray ..	..	..	..	5·75	..	5·75	..	4·50	7·50	12·00	..	9 15 0	Western and Murray Co-operative Bacon and Meat Packing Co. Ltd., 522 Flinders-lane, Melbourne
,, ,,	Pridham's ..	..	..	..	5·00	..	5·00	..	6·00	8·00	14·00	..	9 10 0	W. Pridham Pty. Ltd., Evans-st., Braybrook
,, ,,	Kitchen's ..	..	..	..	..	7·00	7·00	..	9·00	5·00	14·00	..	11 0 0	J. Kitchen and Sons Pty. Ltd., Ingles-st., Port Melbourne
,, ,,	Champion ..	..	..	..	7·00	..	7·00	..	3·50	4·50	8·00	..	9 0 0	Sims Cooper (Freezing Works) Pty. Ltd., 31 Queen-st., Melbourne
,, ,,	Fitzgerald's ..	..	..	..	5·00	..	5·00	..	7·00	10·00	17·00	..	8 15 0	P. Fitzgerald and Sons Pty. Ltd., Warragul-rd., Oakleigh
,, ,,	T.B. and S. in diamond (Portland)	..	..	..	6·00	..	6·00	..	7·00	5·00	12·00	..	10 2 3	Thos. Borthwick and Sons (A'asia) Ltd., 84 William-st., Melbourne
,, ,,	T.B. and S. in diamond (Brooklyn)	..	..	..	6·00	..	6·00	..	7·00	5·00	12·00	..	10 3 1	,, ,, ,,
,, ,,	T.B. and S. in diamond No. 2 (Brooklyn)	..	..	..	4·50	..	4·50	..	7·00	11·00	18·00	..	10 3 1	,, ,, ,,
,, ,,	Apex ..	..	..	..	..	4·50	4·50	..	7·00	9·00	16·00	..	9 5 0	North-Eastern Bone Products, Wangaratta
,, ,,	Pannifex (C)	..	..	..	..	5·00	5·00	..	6·00	8·00	14·00	..	8 10 0	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster - terrace, North Melbourne
,, ,,	Arch ..	..	..	..	5·50	..	5·50	..	9·00	7·00	16·00	..	9 10 0	Victorian Inland Meat Authority, 54 Market-st., Melbourne
,, ,,	Pentagon ..	..	..	..	5·61	..	5·61	..	8·64	8·25	16·89	..	10 6 0	Mulgrave By-Products Co., North-road, East Oakleigh
,, ,,	Sayer ..	..	..	..	4·25	..	4·25	..	8·85	9·90	18·75	..	9 0 0	Sayer and Co. Inc., Laverton
Animal Fertilizer	A and A Surprise	..	..	..	..	5·00	5·00	..	4·00	10·00	14·00	..	9 10 0	G. W. Pennell (dec'd.), Burke-st., Braybrook
,, ,,	Valley ..	..	..	..	..	7·70	7·70	..	3·30	2·80	6·10	..	9 5 0	Chas. Cowley and Co. (Aust.) Pty. Ltd., P.O. Box 124, Shepparton
COMPLETE FERTILIZERS.														
Containing Nitrogen, Phosphoric Acid, and Potash—Readily Available														
Complete Fertilizer	Sickle in diamond (Market Garden) No. 2	..	3·10	..	..	0·75	3·85	14·30	1·00	1·40	16·70	2·20	11 17 9	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne

* F.o.r. at Melbourne or Railway Sration nearest place or manufacture.

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE FERTILIZERS ACT 1928 (No. 3680) FOR THE YEAR 1949—*continued.*

Description of Fertilizer.	Brand.	Nitrogen.						Phosphoric Acid.				Potash as Unspecified.	Price asked per ton.*			Where Obtainable.
		As Nitrate.	As Ammonia.	As Blood.	As Blood and Bone.	As Blood, Bone, and Flesh.	Total.	As Water Soluble.	As Citrate Soluble.	As Citrate Insoluble.	Total.		£	*s.*	*d.*	
		%	%	%	%	%	%	%	%	%	%	%				
COMPLETE FERTILIZERS—*continued.*																
Containing Nitrogen, Phosphatic Acid, and Potash—Readily Available—continued.																
Complete Fertilizer	Sickle in diamond (A) (5.1.1)	..	2·90	..	..	..	2·90	14·60	0·40	0·70	15·70	6·40	13	4	0	Commonwealth Fertilizers and Chemicals Ltd., 65 William-st., Melbourne
,, ,,	Sickle in diamond (B) (5.2.1)	..	5·00	..	..	..	5·00	12·80	0·30	0·60	13·70	5·60	14	4	6	,, ,, ,,
,, ,,	Sickle in diamond (C) (4.4.1)	..	9·15	..	..	..	9·15	9·10	0·20	0·40	9·70	5·00	16	8	9	,, ,, ,,
,, ,,	Sickle in diamond (D) (2.2.1)	..	8·20	..	..	..	8·20	8·20	0·20	0·40	8·80	9·00	17	19	6	,, ,, ,,
,, ,,	Pivot IV. (5.1.1)	..	2·90	..	..	..	2·90	14·30	0·30	0·70	15·30	6·90	13	4	0	The Phosphate Co-operative Co. of Aust. Ltd., 447 Little Collins-st. Melbourne
,, ,,	Pivot V. (2.2.1)	..	8·20	..	..	..	8·20	8·20	0·20	0·40	8·80	9·60	17	19	6	,, ,, ,,
,, ,,	Pivot VI. (4.4.1)	..	9·10	..	..	..	9·10	9·10	0·20	0·40	9·70	5·30	16	8	9	,, ,, ,,
,, ,,	Cresco No. 1 (5.1.1)	..	2·90	..	..	..	2·90	14·64	0·36	0·70	15·70	6·43	13	4	0	Cresco Fertilizers Ltd., Geelong
,, ,,	Cresco No. 2 (4.4.1)	..	9·15	..	..	..	9·15	9·11	0·22	0·44	9·77	5·00	16	8	6	,, ,, ,,
,, ,,	Cresco No. 3 (5.2.1)	..	5·00	..	..	..	5·00	12·80	0·30	0·62	13·72	5·62	14	4	6	,, ,, ,,
,, ,,	Cresco No. 4 (2.2.1)	..	8·24	..	..	..	8·24	8·20	0·20	0·40	8·80	9·00	17	19	6	,, ,, ,,

Description of Fertilizer.	Brand.	Nitrogen as Bone.	Phosphoric Acid.	Mechanical Condition.		Price asked per ton.*			Where Obtainable.
				Fine Bone.	Coarse Bone.	£	*s.*	*d.*	
		%	%	%	%				
Bonedust ..	Apex ..	3·25	20·00	50·0	50·0	8	15	0	North-Eastern Bone Products, Wangaratta
,, ..	Mount Clear ..	3·00	19·00	50·0	50·0	7	15	0	Bailey Bros., Mount Clear, via Ballarat
,, ..	Pannifex ..	2·50	26·00	50·0	50·0	9	0	0	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
,, ..	Fertillo ..	1·00	30·0	95·0	5·0	11	17	6	Glues and By-Products Pty. Ltd., 86 King-street, Melbourne
,, ..	T.B. and S. in diamond Brooklyn	2·50	24·0	50·0	50·0	9	13	1	Thos. Borthwick and Sons (A'asia) Ltd., 84 William-street, Melbourne
,, ..	T.B. and S. in diamond Portland	2·50	24·00	50·0	50·0	9	12	3	,, ,, ,, ,, ,, ,,
,, ..	VIMA ..	5·00	20·00	62·0	38·0	10	0	0	Victorian Inland Meat Authority, 54 Market-street, Melbourne
,, ..	Bendigonian ..	3·75	23·16	62·0	38·0	11	0	0	Bendigo Fertilizer and Wool Co. Pty. Ltd., Charing Cross, Bendigo
,, ..	Haermei ..	3·93	24·27	53·0	47·0	10	0	0	J. Vernon, Vinifera

* F.o.r. at Melbourne or Railway Station nearest place of manufacture.

Melbourne, 2nd December, 1948.

W. R. JEWELL, M.Sc., F.R.I.C.,
Chemist for Agriculture.

TUBERCLE-FREE HERDS

ACCREDITED TUBERCLE-FREE HERDS

The following herds have been declared free of tuberculosis under the *Accredited Tubercle-free Herd Scheme* conducted by the Department of Agriculture. Under this scheme a tubercle-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests or upon disclosure of infection, three semi-annual, successive physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

Name.	Address.	Number in Herd.
Aboriginal Station	Lake Tyers	86
Ampt, E. W.	Gymbowen	12
Ampt, N. C.	Gymbowen	21
Ballarat Orphanage	Ballarat	139
Banyule Stud Pty. Ltd.	Wangaratta	55
Beggs, A. R.	Beaufort	116
Black, I. S., Estate of	Mount Noorat	64
Bleakley Bros.	Horsham	18
Bott, J.	Yarrawonga	70
Bruhn, C. H. and V. I.	Mirboo North	54
Candler, G. E.	Hamilton	35
Carne, W. J.	Pakenham Upper	30
Cason, J. M.	Lima South	63
Clark, W. J.	Monomeith	142
Cowan, G. L. S.	Bacchus Marsh	59
Cox, F. G.	"Birradale," South Lyndhurst	47
Cribbes, T.	Wangaratta	40
Deering, J. T.	South Wangaratta	79
Dookie Agricultural College (Ayrshire Herd)	Dookie	117
Dookie Agricultural College (Hereford Herd)	Dookie	38
Eagle, W. H.	Womerah	31
Everist, F. R.	Tyabb	12
Fisher, A.	Boisdale	26
Foletta, G. G., and Son	Buxton	121
Geelong Grammar School	Corio	81
Gilbert, J. A. and R. D.	"Brockelbank," Yinnar South	108
Gilmour, D. W., and N. B.	"Yarravale," St. Hubert's-lane, Yering	121
Gleeson, P. J., and Son	Tynong	261
Gorman, A. W.	"Cathcart," Alexandra	57
Griffiths, J. G.	Benalla	121
Gross, Mrs. G. F.	Horsham	33
Hamilton, A.	Flinders	69
Henry, J. A.	Merrivale	40
Howlett, Mrs. G., and Miss E. Samuel	Lang Lang	84
Ivone, M. and Sons	Ovens	103
Jackson, H.	Lockington	81
Johnson, F. G.	Horsham	34
Jones, A. C.	Barnawatha	182
Keele, H. A.	Bamawm	79
Kelynack, P. T.	Bundoora	90
Kemp, E. J.	Horsham	16
Kingsley-Newell, F. J.	Shoreham	60
La Fontaine, G.	Mitta Mitta	61
Lawrence, P. H.	"Rainga," Tarrawarra	89
Lawton, W.	Frankston	56
Light, D. T.	Noradjuha	12
Longerenong Agri. College	Dooen	49
Luke, K. G.	Romsey	32
Maloney, P. J.	Tongala	66
Maybery, A. H.	Mitre	13
Middleton, J. A.	Labertouche	80
Moore, J., and Co.	Yarram	109
Murray, M. G.	Lima	19
McIntosh, J.	Merrigum	44
McKenzie, A. E.	Kerang	54
McKenzie, Mrs. E. J.	Woodford	81
McKenzie, H. P.	Trawalla	15
McNabb, G. A., and Son	Irrewillipe East	196
Nancarrow Bros.	Kerang	56
Newton, J. M., and Sons	Whorouly	63
Nicholas, M. A.	Sherbrooke	79
Noonan, Mrs. S. A.	Benalla	68
Northcote Children's Farm	Bacchus Marsh	83
Onley, W. H.	"Glenholme," Caldermeade	88
Payne, A. E. T.	"Yarra View," Lilydale	78
Payne, T. E. N.	"Woodburn," Kilmore	72
Poole, M. A., and D.	Caldermeade	143
Poole, M. A., and D.	Yannathan	103
Potter, W. J.	Longwarry North	118
Price, L. E.	Ellerslie	78
Prosser, J. E.	Ondit	40
Read, exors., Estate I. D.	Springhurst	99
Rix, A. A.	Officer	79
Roe, Thomas H. P.	Cobram	15
Sanderson, R. F.	"Pleasant Hill," Kyneton	75
School of Horticulture	Burnley	9
Scott, A. L.	"Wolonga," Kongwak	43
Scott, F. E. Selwyn	Scotsburn	76
State Experiment Farm	Rutherglen	49
State Research Farm	Werribee	203
Stephens, Dr. F.	Vermont	34
St. Joseph's Home	Sebastopol	59
Thomas and Taylor Pty. Ltd.	Hamilton	26
Till, J. A.	Tongala	58
Tucker, E. G.	Horsham	71
Vagg, T. R.	Officedale	56
Vagg, F. G.	Leongatha	57
Variety Investments Pty. Ltd.	Woori Yallock	127
Warnock, J. A.	Lima South	77
Waterhouse and Son	Pakenham	67
Williamson Bros.	Carisbrook	119
Wilson, J. L.	Koo-wee-rup North	90

In addition to the above the following is a list of herds in their respective districts which have given negative reactions to two or more successive tests conducted by departmental veterinary officers, but, inasmuch as replacement cows are only submitted to one test before being admitted to the herds, they cannot be considered as accredited under the Accreditation Scheme which requires, among other things, that no cow shall be admitted to the herds unless it has given two (2) negative reactions at an interval of 60 days, and must be kept in isolation during the period between the two tests.

District.	Herds.	Cattle.
Ararat	11	291
Bairnsdale	4	109
Ballarat	122	3,050
Benalla	43	298
Bendigo	85	3,159
Broadmeadows	42	1,982
Colac	9	263
Doncaster	16	668
Geelong	101	3,692
Hamilton	2	94
Heidelberg	19	593
Horsham	9	468
Morwell	3	270
Orbost	1	99
Portland	7	431
Rutherglen	20	296
Sale	5	341
Terang	1	10
Traralgon	4	218
Wangaratta	38	475
Warrnambool	7	428
Whittlesea	105	4,485
Yallourn	4	269
Yarragon	36	1,630
Yea	26	73

There are also 399 herds in which 16,351 head of cattle have passed one test and may be considered, therefore, to be in process of becoming tubercle-free herds.

HORTICULTURE ABROAD

By Frank M. Read, M.Agr.Sc., Chief Inspector of Horticulture

Late last year, the writer of this article returned to Australia after having spent about five and a half months examining various aspects of horticulture in England, Holland, Canada, and the United States of America "It is not to be expected that one could become knowledgeable on all aspects of horticulture in these countries in such a short space of time," he says. "Nevertheless, I have learned many things which I feel will be of great value to me in my work, and also of interest to Victorian horticulturists." The writer asks that the following brief comments on a few of the highlights should not be taken as a report, which will be much more comprehensive and will take some time to prepare.

Propagation beds at East Malling Research Station, England, where the new races of apple rootstocks, immune to woolly aphis, are the main centre of interest.

BROADLY speaking, Australians are aware of most of the modern trends in world horticulture today, though distance from other lands sometimes obscures the details and the objectives. One great value of such a trip is the permanent nature of personal contacts made and the filling in of an enduring background against which future reading is viewed.

POST WAR RESEARCH IN ENGLAND

In England, research work is returning to normal after the war. At the East Malling Research Station, in a wide range of active work, particular reference is made to the new races of apple rootstocks which have been bred for woolly aphis resistance, and selected to give a range in vigour from dwarfing to vigorous, as did the original East Malling rootstocks. These stocks are not yet multiplied sufficiently to permit general distribution, but East Malling has generously made available to the Department of Agriculture for experimental work at the Scoresby Research Station, sufficient numbers to permit early trials being made in Victoria.

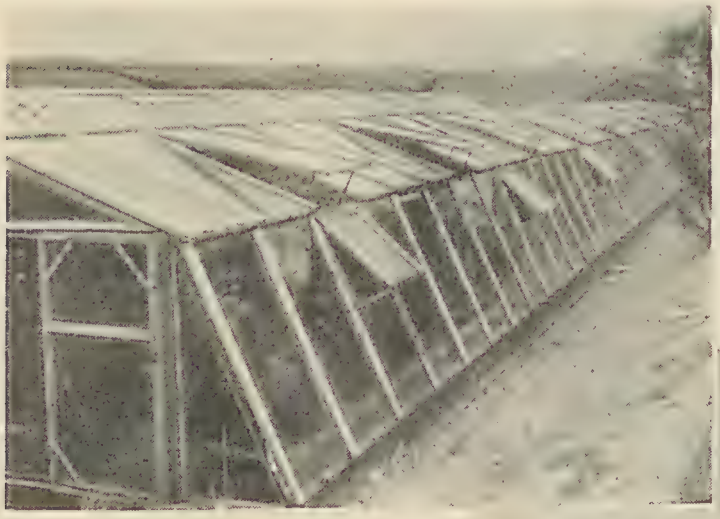
At Long Ashton Research Station, the notable work on plant nutrition is once more being vigorously pursued. The

rapid method of tissue analysis in the field to determine the nutrient status of trees has gone to the advanced practical stage, and the idea of tissue analyses has captivated the horticultural world abroad.

It can be said that, though the methods of analysis used vary quite a lot in the several countries visited, the importance of judging tree nutrition on this sort of basis is clearly seen. We have used such methods to some extent in Australia, and could greatly increase such investigations with advantage.

Again, methods of refrigeration differ from our own in the use of small units placed centrally in rooms, including a cooling coil with a fan which draws the air over the coil and distributes it throughout the room.

In England, Holland, Canada, and the United States, the general principle was accepted that efficient refrigeration demanded some form of forced air movement in the cool room, a system which is particularly useful and, in fact, essential when rapid and safe pre-cooling of fruit prior to storage or shipment has to be undertaken.



Left: A typical "Dutch Light" type of glasshouse in Cornwall, made of standard frames, easily erected and dismantled.

Right: Modern Dutch glasshouses. Note the fine steel framework designed for minimum interference with light.

GAS STORAGE

Gas storage of apples in England is now very general, and interesting developments have occurred. It has always been held in Victoria that the only practicable atmospheres to use would be those obtained by controlling the ventilation to the cool room and relying on the processes of respiration of the fruit to increase carbon dioxide and proportionately decrease oxygen. Our view clearly was wrong, for, in England, quite practical means are adopted, in stores without special technical staff, to control carbon dioxide by means of caustic soda "scrubbers" and obtain, if necessary, atmospheres with very low oxygen concentrations.

GLASSHOUSES OVERSEAS

Glasshouse work in England is very impressive for vegetable and flower production, including "Dutch lights", ranging from small units of about 2 feet in length up to large structures, such as the one illustrated, when they approach the size of normal glasshouses.

Glasshouses recently constructed in Holland were the nearest approach seen to structures which did not interfere unduly with natural illumination. In most glasshouses, the influence of the carpenter is more obvious than that of the horticulturist.

The John Innes Research Station, moving from Merton, near London, to a roomier situation in Hertfordshire, will carry on much needed work on the design of glasshouses, as well as on glasshouse culture. Pending such investigations, no one interested in glasshouse work should fail to see the recently published "Science and the Glasshouse," by Lawrence of John Innes. This book could equally well be entitled "Essentials of Glasshouse Practice".

The "Speed Sprayer" machine, one of the air-carrier types of orchard sprayers which have gone into wide use for pest control in U.S.A.

In Holland, serological methods of identifying virus diseases of plants, developed at the Bulb Research Institute at Lisse by Professor Van Slogteren, are in advance of anything done in this important sphere elsewhere in the world, and, generally, the horticultural research work centred at Wageningen University is very diverse and of a high standard.

PEST CONTROL IN U.S.A.

Perhaps the subject of most general horticultural interest on the North American Continent is that of pest control. Though the use of portable spray machines and stationary spray equipment installed in orchards is still general, very large areas are now being covered by aeroplane and helicopter and by new ground equipment, such as the speed sprayer illustrated. This machine was designed to reduce the current problem of labour shortage and high cost by removing the necessity for hand-operated spray hoses.

The new types of equipment vary widely in principle from the speed sprayer, which normally uses formal spray mixtures delivered by fine jets into a high volume air stream created by a huge fan, to the other extreme where very concentrated sprays are heated, and, as vapor, are drifted in a relatively low volume of air through the foliage.

An "Iron Monkey" framework, in California, fitted to an orchard tractor hydraulically elevated to any height and fitted with "catwalks" for elevated picking, spraying, pruning and other orchard operations.

It is likely that substantial changes in design will occur within the next one or two years, the prevailing aim, so far as could be judged, being to produce a machine, perhaps by combination of the two widely different systems referred to above, in which a large volume of air at a moderate velocity would carry a small quantity of very concentrated spray material in such a way as to completely displace the air enclosed by the tree.

The use of DDT has given rise to a mite problem in America as it has in Australia, and the new insecticide, "Parathion," though not yet approved by the Health authorities, was strikingly successful in controlling mites and is in wide use in some of the Western States of the Union.

REFRIGERATION ON U.S.A. RAILWAYS

The refrigerated cars of the American railroads impressed by their numbers. Everywhere one saw trains of enormous length entirely of refrigerated cars, mostly fitted with end bunkers for ice, and an air-distributing fan driven off the ground wheels.

Top: A general view of the Wenatchee area, most important apple-growing district in the United States. Excellent growing conditions and handling techniques characterize this famous area on the Columbia River.

Right: Section of a Wenatchee orchard.

Facilities for re-icing the cars were available in all fruit centres and along the railway routes, and equipment for sulphuring grapes in transit with sulphur dioxide from special cylinders and heating units was also standard.

Vegetables, such as lettuce from Salinas, were customarily sent across the continent packed in powdered ice in refrigerated cars, and such facilities, coupled with the excellent cool stores capable of rapid and safe precooling, enable such perishable products to be transported long distances without appreciable deterioration.

BERRY FRUIT CULTURE

Berry fruits claim a great deal of attention in other countries, compared with comparative neglect in Victoria, and much interesting material is available for us when, in the near future, we develop this side of the new Research Station at Scoresby. Virus diseases in berry fruits everywhere abroad are taking their toll, as they are here, but, by breeding and appropriate methods of growing under certification, they are, in many places, being held within reasonable bounds.

PROBLEMS

Horticulturists, like agriculturists, throughout the world are, at present, generally prosperous though there was some concern in England last season about the possibility of a glut of plums, and occasionally in America, as in the dried-grape industry of California and the citrus industry, the high wage-level tended to more than offset the comparatively high prevailing prices. Broadly, for instance, canned fruit and dried fruit growers in the United States were receiving approximately the same prices for their fruit as Australian growers, but their wages bill must have been twice to three times as high. This was resulting in the replacement of dried grapes to an appreciable extent by cotton in California, and the citrus industry, though not able to be adjusted as rapidly, seems likely to experience a reduction in acreage.

WINTER DROP OF GRAPEFRUIT

REDUCTION BY SPRAYING

By D. M. McAlpin, B.Agr.Sc., Horticultural Research Officer, and D. C. Merrett, Dip.Agr. (Dookie), Assistant Field Officer

One of the major problems confronting growers of grapefruit in Victoria, the heavy winter drop of fruit, may now be successfully combated by the use of dilute sprays containing the well-known "hormone weed-killer" 2,4-D. In tests carried out by the Victorian Department of Agriculture in various parts of the State, use of this spray reduced the winter drop of grapefruit by as much as 90 per cent. The spray material is not costly.

The recommended spray contains 22 parts per million of a sodium salt of the "growth substance" 2,4-D. One pint of summer white oil is used as a spreader and sticker. The spray is best applied late in May when autumn growth has ceased and, as described in the following report, the spray material should be so directed as to thoroughly wet the calyx of each fruit. Particular care is necessary in time of application and strength of the spray.

The extent to which marketable grapefruits fall from the tree during the winter months, June and July, in Victoria, varies from season to season, district to district, and from one grove to another. However, almost every year it presents growers with a serious problem resulting in glut-deliveries of grapefruits to market and consequent low prices. During the winter of 1948, this "drop" was so great that many trees lost 100 per cent. of their fruit. When it is remembered that the normal time for harvesting grapefruit is late spring and early summer when the demand is greater and prices are much better than earlier in the season, it will be appreciated that the solution of this problem of premature drop is of major importance to the grapefruit industry.

The "winter drop" of grapefruit starts after the autumn growth has matured and virtually stops as soon as the spring growth of the trees commences. Fruit which has held on the tree through the winter until the spring, usually holds quite well till the early summer at least, when a normal pre-harvest drop of mature grapefruit takes place.

As mentioned, the winter drop of grapefruit varies from year to year. In years of heavy cropping there is likely to be a larger fall of grapefruit, but the main factor in this drop seems to be the weather conditions during May, June, and July, which keep the tree and fruits damp over a long period. Heavy dews have a similar effect to lengthy periods of showery weather. Trees suffering from malnutrition, such as nitrogen deficiency or an excess of salt, also drop their fruits more severely than trees in good health.

The fruit which falls from the tree is full-grown and the rind has changed from green to a waxy yellow colour just before the "drop" period.

With windfall citrus fruits it is well known that a corky (abscission) layer forms between the calyx and the fruit and weakens the hold of the fruit on the tree. It appears that this formation results from the lack of some minute amount of chemical (hormone) within the plant.

PREVENTION OF DROP

In 1941 and 1942 experiments were carried out using alpha naphthalene acetic acid sprays in an attempt to prevent or reduce the winter drop of grapefruit. This growth substance did not have the desired effect, though it had been successful in reducing the pre-harvest drop of apples and pears. Following the war, further detailed experimental work at Wangaratta, Swan Hill, and Mildura on this grapefruit

The bearing habit of Marsh Seedless grapefruit is clearly shown in this picture. Apply the 2,4-D spray to wet the calyx of each fruit and then examine the calyces of fruits to make sure a good job has been done.

drop problem has included the successful use of sprays containing small amounts of the well-known so called "hormone weed-killer"—sodium 2,4-D. This chemical is the sodium salt of 2,4 dichloro-phenoxy-acetic acid.

STRENGTH OF SPRAY

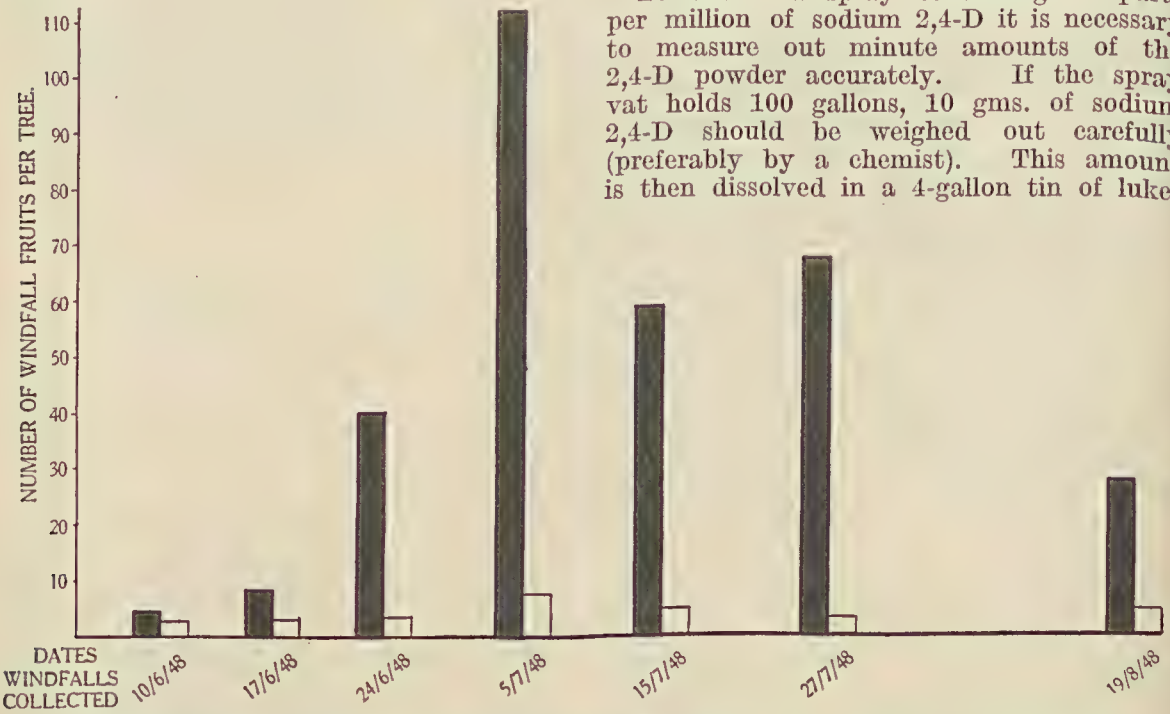
Sprays applied at strengths ranging from 10 to 22 parts per million of sodium 2,4-D, (i.e., 8 to 17 parts 2,4-D acid) have given spectacular results in stopping from 67 to 89 per cent. of the winter drop of grapefruit. Good results have also been obtained with the same spray in reducing the pre-harvest drop of lemons and oranges.

The best strength to apply the sodium 2,4-D is at 22 parts per million. One pint of summer white oil is added as a spreader and sticker.

If distortion of growth is feared, growers may use a spray containing 10 parts per million soduim 2,4-D, which is not quite so effective in preventing fruit drop as the stronger spray.

PREPARATION

To obtain a spray containing 22 parts per million of sodium 2,4-D it is necessary to measure out minute amounts of the 2,4-D powder accurately. If the spray vat holds 100 gallons, 10 gms. of sodium 2,4-D should be weighed out carefully (preferably by a chemist). This amount is then dissolved in a 4-gallon tin of luke-



The graph gives the average number of windfalls per tree recorded from replicated experimental plot on Mr. R. D. Hollins' grove at Red Cliffs. Trees were sprayed on 3rd June, 1948, at a strength 22 parts per million of sodium 2,4-D. Comparison of the unshaded columns (sprayed trees) and black columns (unsprayed trees) indicates the effectiveness of the spray in reducing the number of windfall fruits. This clear-cut advantage was not so obvious during the first week or two after spraying.

warm water before being added to the spray vat which has previously been three-quarters filled with water.

The agitator should be in constant operation to assist in mixing the spray thoroughly. One pint of white oil which has been broken down in 4 gallons of water is added to the vat before the balance of the water is finally poured in to make up to the necessary 100 gallons.

The careful weighing by a chemist of the 10 gms. of the 2,4-D powder is necessary to avoid damage to trees through possible overdoses of the active growth substance.

It is understood that the chemical firm which supplied the materials for the experimental work intends marketing the sodium 2,4-D in a liquid form which can be readily measured out by growers to obtain the desired strength of spray. The need for dissolving the spray material is thus obviated.

Left—An unsprayed grapefruit tree on Mr. R. D. Hollins' grove.

Top—A sprayed tree on the same property (strength of spray 22 parts per million, sodium 2,4-D). In each instance one week's fall during the trial period is represented.

METHOD OF APPLICATION

In spraying grapefruit trees to prevent this drop the 2,4-D should be applied to thoroughly wet the calyx of each fruit as the 2,4-D absorbed at that point prevents the formation of the corky layer between the calyx and the fruit which causes the fruit to fall from the tree. After spraying a tree, the operator should examine the calyces of the fruits to see that a thorough job has been done.

AMOUNT OF SPRAY REQUIRED

The amount of spray required for each tree is no more than for a normal oil spray for scale insects. With the standard equipment, working with single or twin nozzles at a pressure of 300 lb. per square inch, a grapefruit tree 10 feet high requires 8 to 10 gallons of spray.

PRICE OF SPRAY

The 2,4-D spray is cheap; 1 lb. of the particular brand of weed-killer as used in of the six experimental plots throughout northern Victoria, is sufficient to make over 4,500 gallons of spray containing 22 parts per million of sodium 2,4-D. Including the white oil as spreader and sticker the cost of materials for a 100-gallon vat should not exceed 2s. 6d. to 3s. This will be one of the cheapest sprays in a grapefruit grower's programme.

WHEN TO APPLY

For the winter drop of grapefruit the best time to spray the trees with 2,4-D is during late May when the autumn growth has just matured and before the drop is expected to commence.

The timing of the spray application is important because distortion of young immature leaves and shoots occurs when they are sprayed at the recommended strength; *so on no account should growers spray grapefruit trees, during a growth period, at the rate of 22 parts per million sodium 2,4-D.*

ACTION OF SPRAY

During the early winter, the growth substance 2,4-D is only slowly absorbed into the tree tissues owing to the reduced breathing or respiration of the tree and its action in preventing drop is not fully evident for a week or more.

Trees which have been sprayed with 2,4-D not only have a greatly reduced number of windfalls, but the remaining fruits hang tightly on the trees. Growers have remarked how fruits from such trees are not pulled off easily.

Fruits from unsprayed trees, on the contrary, almost fall into the picker's hand at the first touch. The absorption by the grapefruit tree of the 2,4-D has held the fruit more tightly on the tree by preventing the formation of the corky layer between the calyx and the fruit.

DURATION OF EFFECT

The good effect of the 2,4-D spray in preventing drop lasts for at least five months, and, in this respect, differs greatly from alpha naphthalene acetic acid sprays used to control the pre-harvest drop of apples. In all the experiments during 1948, the 2,4-D spray applied in late May and early June was reducing the normal pre-harvest drop of grapefruit in early December.

It can be stated that the sodium 2,4-D spray will hold the fruit on the tree over the critical winter period.

DANGERS

The danger of the spray to grapefruit trees by distortion of young leaves and shoots is not apparent if the spray is applied at the time and strengths mentioned. Similarly, no ill effects due to this spray have been noted on the flowering, cropping, or fruit quality of grapefruit trees.

It has not been possible yet to determine whether trees sprayed year after year with 2,4-D will finally be adversely affected.

A note of warning is issued to growers that, after using 2,4-D sprays, they should thoroughly flush out their spray pump with clean water.

RESULTS OF SPRAYING WITH SODIUM 2,4-D FOR PREVENTION OF WINTER DROP OF GRAPEFRUIT.

Experimental Plots.	Spraying Dates.	Final Count.	Number of Weeks.	Number of Windfalls per Tree.		Ratio Unsprayed/ Sprayed.	Reduction in Number of Windfalls as Result of Spraying with Sodium 2,4-D.
				Sprayed.	Unsprayed.		
							%
Mrs. Cotton, Wangaratta ..	28.5.48	3.8.48	10	22	116	5·3	81
T. Colson, Wangaratta ..	10.6.48	3.8.48	8	11	53	4·7	79
H. S. Argyle, Lake Kangaroo	3.6.48	5.8.48	9	91	271	3·0	67
*R. D. Hollins, Red Cliffs (1) ..	3.6.48	19.8.48	11	36	326	9·1	89
*R. D. Hollins, Red Cliffs (2) ..	3.6.48	19.8.48	11	120	435	3·6	72
D. B. Halhed, Merbein ..	4.6.48	20.8.48	11	28	102	3·6	72

The results in the above table would have been far more spectacular if the "drop" figures for the first week after spraying had been ignored. This stresses the need for spraying before the drop has commenced.

* R. D. Hollins (1), strength of spray, 22 parts per million sodium 2,4-D. * R. D. Hollins (2), strength of spray, 11 parts per million sodium 2,4-D.

ACKNOWLEDGMENTS.

The sodium 2, 4-D used in the grapefruit drop experiments was supplied without cost by Messrs. Victor Leggo and Farmers Ltd.

The Department of Agriculture also acknowledges the co-operation of the following citrus growers in making available grapefruit trees for the control experiments:—

Messrs. D. B. Halhed, Merbein; R. D. Hollins, Red Cliffs; H. S. Argyle, Lake Kangaroo; T. Colson, Wangaratta; and Mrs. Cotton, Wangaratta.

The authors wish to thank the undermentioned orchard supervisors of the Department of Agriculture. Without their assistance the experiments could not have been carried out:—

Messrs. R. Roberts and R. Hope, Mildura; R. H. Broome, Swan Hill; and I. E. Ebbott, Wangaratta.

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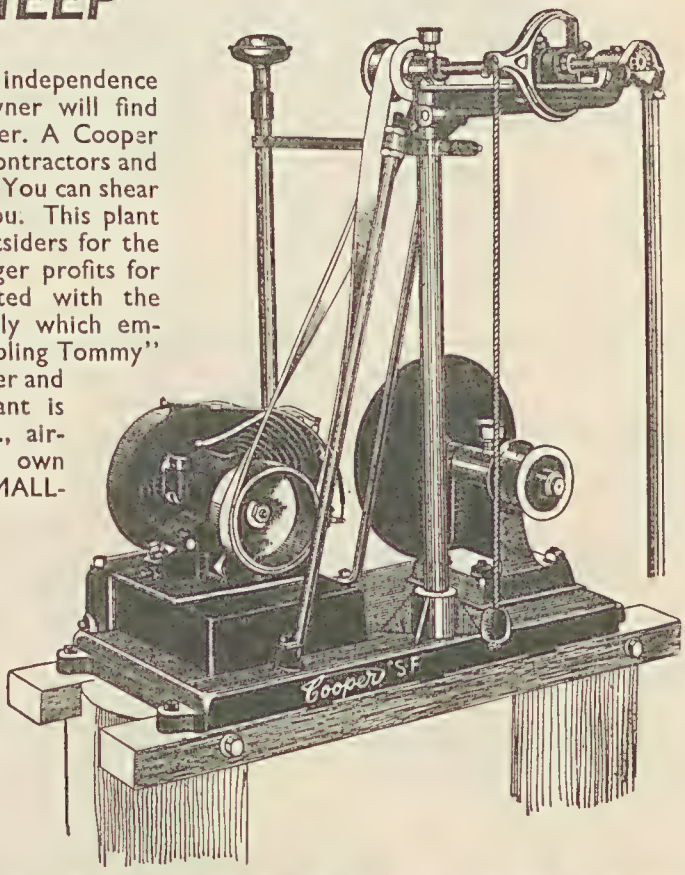

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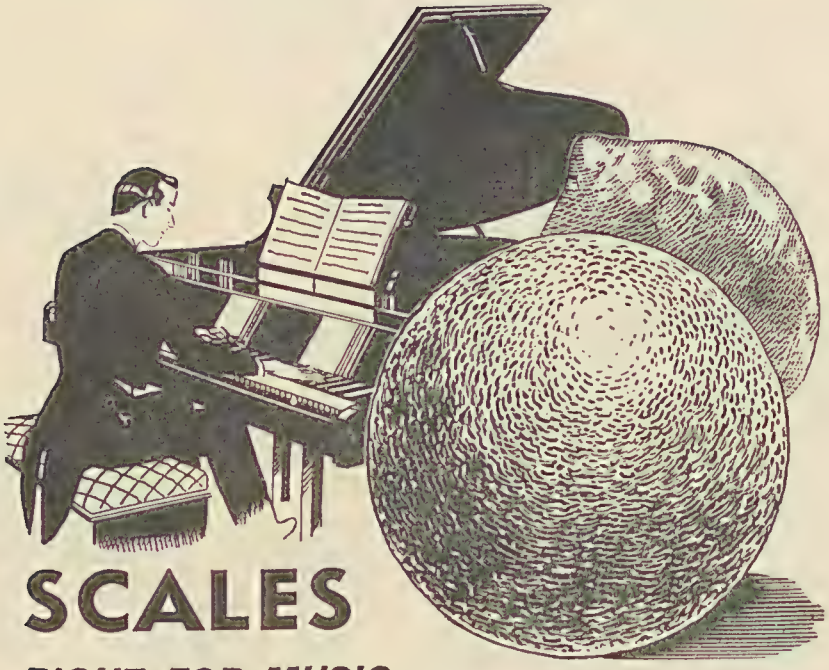

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WALPEUP WHEAT CROP COMPETITION

REPORT OF THE JUDGE

J. M. McCANN, B.Agr.Sc., Manager,
Mallee Research Station, Walpeup

THE wheat crop competition conducted this season by the Walpeup branch of the Victorian Wheat and Wool Growers' Association was keenly contested by twelve competitors. The season was rather more favourable than that experienced in many other parts of the Mallee.

The first three months of the year were dry, and there was no opportunity for cultivation of fallows to control paddy melons, heliotrope, mustard, and other weeds which came away rapidly after the early summer rains.

Good opening rains were received in the second week in April, and these were followed at nicely spaced intervals by further soaking rains in May, June, and late July. It was indeed fortunate that a late July rain of 71 points was received, for it carried the crops through a dry August when little useful rain fell.

At the end of August the need of rain was most urgent but no relief came until September 15th, when an unexpected thunderstorm produced 40 points. The response of crops to this fall was little short of amazing, but, with no further useful rain until October 11th, much of this advantage was lost.

The fate of most early crops had been decided before the October rains which came too late except to improve the size of the grain already formed.

However, late crops, which were in a precarious position before the rain, benefited greatly, and the relatively cool spring enabled them to finish satisfactorily.

The monthly rainfall at the Mallee Research Station for 1948 was as follows :—

Month.	1948.	Average 37 Years.
	Points.	Points.
January	16	67
February	20	107
March	8	78
April	115	70
May	156	117
June	152	130
July	99	118
August	53	128
September	59	129
October	350	133
November	114	89
December	111	97
Total	1,253	1,263

Typical heads of Insignia. This variety was grown by nine of the twelve competitors

The relatively greater importance of distribution of rainfall as compared with total rainfall is well illustrated by these figures. Although rainfall at the Mallee Research Station in 1948 to the end of September was 2·6 inches below average, most early crops in the district would have returned very fair yields without further rain. It should also be noted that, although the total rainfall for the year was practically equal to the average, it was 1·6 inches above average in the growing period, April to October, which explains in part the reason for an estimated district yield of 10 per cent. above average.

WHEAT VARIETIES

One of the most valuable features of crop competitions is the discussion between judge and competitors on wheat varieties—a subject of never-failing interest and of considerable importance to the farmer who has to decide very soon after harvest which varieties he will retain or discard next season.

Insignia

In the Walpeup district, Insignia is undoubtedly first favourite, and it will be seen that nine of the twelve competitors chose this variety. In most cases it was considered to be their highest yielding crop this season.

Although released for sowing only in 1946, Insignia is quickly establishing itself as a popular Mallee wheat and it is expected that the area sown in 1949 will show a further increase over the 333,000 acres or 25 per cent. of the Mallee acreage sown in 1948.

The advantage to the farmer of an early-maturing wheat such as Insignia was well illustrated early in October when it seemed that the rain would not come in time to benefit the early crops or to save the late crops from complete failure. At that stage it was apparent that even without any further useful rain, Insignia would assure the farmer a better than average yield.

As such conditions are not uncommon in the Mallee, it is essential that an early-maturing variety be sown on the larger proportion of the Mallee acreage and especially in the Northern and Central Mallee.

Bencubbin and Gabo

Other early-maturing varieties entered in the competition were Bencubbin and Gabo.

Bencubbin has waned a little in popularity owing to the replacement of part of the area formerly sown to this variety by Insignia. Nevertheless it is grown on about one-seventh of the Mallee and it still has a strong following.

Most farmers do not attempt to handle a very large area of Bencubbin on account of the straw weakness which it frequently exhibits, but in the experience of many, this variety will yield well even when there is some loss due to lodging.

Gabo is a variety which has captured the imagination of many farmers after their unfortunate losses due to stem rust with most other varieties in 1947. Gabo is a rust-resistant variety, and one of the most promising wheats introduced from other States. It is a short-strawed, early-maturing wheat which has a pronounced tip beard and light-coloured chaff. It should be remembered, however, that losses due to rust are a rare occurrence in the Victorian Mallee, and a rust-resistant variety should

not be adopted unless its yield in rust-free seasons closely approximates to the yield of the standard varieties. It must also possess satisfactory harvesting characteristics, grain quality, and other features.

A number of farmers in the Mallee grew Gabo this season and its yield performance in wheat variety trials conducted by the Department of Agriculture will shortly be announced. Farmers may wish to try this variety for themselves, but, until further evidence is available, it cannot be recommended for general Mallee sowing.

Quadrat

Quadrat was shown by two competitors. Although a number of district farmers were disappointed with the yield of Quadrat this season it is the most popular wheat in the Mallee and all the other main wheat-growing districts of the State. It is the most prolific of the later-maturing wheats, but, in Mallee tests, it has not proved equal to Insignia.

It was expected that the later-maturing wheats would take full advantage of the heavy October rains and return high yields, but it appears that they were at a critical stage of their development at the driest part of the season. The yields obtained were relatively low and a proportion of the grain was shrivelled.

WEEDS

Practically all competitors had been troubled with a heavy growth of summer weeds, especially paddy melons and heliotrope, on their fallows, and this was very apparent to the judge when he obtained from competitors particulars of the preparation of their fallows.

Heavy rains in December, 1947, fell inopportunely, as most farmers were busy with their harvest and could spare little time for their fallows. Although the period during which the fallow can be satisfactorily worked after summer rains may be short, the opportunity to cultivate those areas showing excessive weed growth or a tendency to drift, should not be missed.

As mentioned earlier the first three months of 1948 were especially dry and the desired wet-working of fallows to control the phenomenal growth of summer weeds could not be given. In the circumstances many farmers had to choose the lesser of two evils and disc their fallows dry to make sowing possible.

One sometimes hears the opinion expressed that the fallow that grows paddy melons is a good fallow. This growth does indicate there is good moisture in the fallow but there would be better moisture if the "paddies" were controlled.

Another claim made by some and offered as an excuse for dirty fallow, is that the weed growth checks erosion and is to be preferred to the bare fallow that drifts. It is a better policy to prepare, by utilizing straw residues or sowing a cover crop, a fallow that will not drift readily.

Weed Control on Cover-Cropped Fallow

As the spring and early summer of 1948 were conducive to the growth of summer weeds on fallows, attention is drawn to the many advantages of some modified form of fallow such as the cover-crop fallow. A light seeding of oats—30 to 40 lb. per acre—is sown late in August or early in September (depending on rains) on land which has been fallowed and treated in the normal manner until this time. The crop is grazed down after the plants have become firmly established and the roots and remaining stalks are expected to hold the soil until after the summer.

One big advantage which cover-cropped fallows have had over "bare" fallows in the past two seasons is that, once growth of the cover crop has been controlled by grazing, it has not been necessary to give it any attention until the autumn, when it is again worked in the usual way. If

Cover-crop fallow at the end of summer. The grazed stubble has prevented the soil from drifting.

those portions of the fallow most liable to drift are so treated the area of bare fallow requiring cultivation after spring and summer rains is reduced and a better control of weed growth is possible.

The reduction in yield due to the cover crop will vary from season to season according to the growth made by the cover crop and the rainfall, but the average reduction during six years of tests at the Mallee Research Station was 1·3 bushels per acre.

The loss in yield due to a heavy growth of summer weeds in some seasons would be much greater than this. Furthermore, the weeds do not provide as much useful grazing as the cover crop, they do not give as effective erosion control and preparation of the fallow for seeding may be rendered extremely difficult.

THE COMPETITION CROPS

The twelve crops in the competition were estimated to return an average yield of 20 bushels to the acre, which must be regarded as very satisfactory.

The rate of seeding adopted by competitors ranged from 45 to 60 lb. per acre and averaged 53 lb.

The quantity of superphosphate used ranged from 45 to 65 lb. per acre and averaged 57 lb.

One crop was sown dry before the " break " on 19th April and the last was sown during the first week in June. Most of the crops were sown during the second week in May.

The competition was won by Mr. J. Williams and his exhibit represented the Walpeup district in the Mallee Wheat Crop Championship. It was a well-grown, well-headed crop of Insignia, a great deal of which would yield nine bags to the acre. The main weakness of the crop from the competition angle was that insufficient care had been taken to maintain the purity of the seed.

The land on which the crop was sown was fallowed in July with a twin-disc plough. The paddock was not very " dirty " and sheep were used to control weeds until just before the " break " in April, when it was skimmed with the disc to destroy paddy melons and mustard. Sowing took place in the middle of May using 55 lb. of copper-pickled seed and 45 lb. of superphosphate per acre.

Preparing a fallow with a twin-disc plough.

Second place was awarded to another crop of Insignia exhibited by Mr. F. J. Wakefield. Mr. Wakefield's crop was expected to yield slightly better than the winning crop and, although of better purity, it lost points in the other sections.

Mr. Wakefield's fallow was prepared with the twin-disc plough in August, scarified at the end of September and again early in May and sown in the second week of May with 53 lb. of seed and 60 lb. of superphosphate per acre.

Third place was gained by Messrs. Vallance Bros. for an entry of Insignia and Gabo, which was within a point of the winning crop. The land was fallowed with a twin-disc plough in August, worked with the combine in December, and again early in May. Seeding took place in the third week in May using 56 lb. each of seed and superphosphate.

The detailed awards are set out in the table on the next page.

Walpeup Wheat Crop Competition 1948—List of Awards.

Competitor.	Variety.	Yield.	Purity and Type.	Absence of—		Evenness.	Total.
				Weed.	Disease.		
Maximum points	.. .. ..	35	20	15	15	15	100
J. Williams	Insignia	34½	18½	14	15	14½	96½
F. J. Wakefield	Insignia	35	19½	13	14	14½	96
Vallance Bros.	Insignia and Gabo ..	33½	19	14	15	14	95½
A. McKinnon	Insignia	32	19½	14½	15	14	95
D. Leach	Sepoy and Insignia ..	32	18½	14½	14½	14½	94
J. H. Smith	Insignia	33½	18	13	12½	14	91
Gniel Bros.	Quadrat	27	19½	14½	15	14	90
P. A. Hannig	Insignia	27	19	14	14½	14½	89
R. H. Mead	Insignia	27	18½	14½	14½	14	88½
Bell Bros.	Bencubbin and Insignia ..	28	18	13	13	13	85
J. E. Mengler	Quadrat	25	19	12	13½	14½	84
P. B. Leach	Bencubbin	25	19	14½	13½	12	84

Journal of Agriculture, Index for 1948

Copies of the Index of the *Journal of Agriculture* for 1948 have now been printed, and may be obtained, free of charge, on application to the Stores Branch, Department of Agriculture, Melbourne, C.2.

Burning Off—Landholders' Obligations

The Forests Commission issues the following advice to landholders concerning their obligations when burning-off.

Briefly, the landholder's position is this:—If his land is located within one mile of any National Park, reserved forest, or unoccupied Crown land and is not within the Mallee, he must obtain a written permit from the Forest Officer if he desires to burn bracken, scrub, or timber at any time between 15th November and 15th March, or at any earlier or later date which may be proclaimed a Prohibited Period.

If the land is in the Mallee or is more than one mile from a National park reserved forest, or unoccupied Crown lands, a landholder desiring to burn any type of material must first obtain a written permit from the proper officer of the municipality in which he resides, if such burning is to be done within a period proclaimed by the Country Fire Authority as a Summer Period. These summer periods vary according to the climatic conditions, but, in general, run from about mid-December until the end of March.

On any day proclaimed an "acute fire-danger day" by the Country Fire Authority through the medium of broadcasting stations, no fire shall be lit or left burning in the open air, irrespective of whether a permit has been obtained or not.

Before lighting up, the landholder should give his neighbours 24 hours notice in writing as required under the Police Offences Act.

RECOMMENDED CEREAL VARIETIES

By W. B. MILLER, M.Agr.Sc., Senior Inspector of Agriculture

A. WHEAT VARIETIES FOR GRAIN

DURING the past few years Victorian farmers have successfully adopted the new improved wheats produced by the Department of Agriculture, and statistics indicate a marked change in the areas sown to the main varieties; e.g., in 1941, the variety, Ghurka, was sown on 63 per cent. of the area sown to wheat in the Wimmera, but last year occupied only 7 per cent. of the area, having been replaced largely by Quadrat (61 per cent.), Pinnacle (10 per cent.), and Magnet (10 per cent.).

In the Mallee similar changes have taken place, Ghurka and Ranee 4H having been displaced by Insignia, Bencubbin, and Pindar.

In the Northern districts, Quadrat and Magnet have become popular at the expense of Ghurka.

Further changes are now in progress, following the distribution by the Department of the two new wheats, Pinnacle (for the Wimmera), and Insignia (for the Mallee), each of which is a distinct improvement in both prolificacy and flour quality on the varieties they will replace in the respective districts for which they are recommended. The plant-breeding programme is being intensified, and it is expected that even better wheats will emerge from the crossbred material now under test.

Having regard to the various environmental conditions in the different districts, and the results of experimental work at the Research Stations and on farmers' plots, the following varieties are recommended for sowing in the districts shown hereunder. The recommendations have been endorsed by the Victorian Wheat Advisory Committee, comprised of representatives of flour millers, bakers, merchants, wheat-growers, and the Department of Agriculture.

WIMMERA (black soils)

Pinnacle, Quadrat, Magnet, Diadem

In all but the driest years the Wimmera black soils have the capacity to mature a heavy crop, and medium to late maturing varieties have proved to be more successful than early-maturing types. Until recently, Ghurka was outstanding in this regard, but Pinnacle, Quadrat, and Magnet have now proved themselves to be more prolific, the latter particularly when it has the advantage of late rains in November.

The new wheat, Pinnacle, is strongly recommended for Wimmera black land, as it has given higher average yields than both Quadrat and Magnet in experiments at Longerenong College and Salisbury during the past six years. It has the additional advantage of being a better-quality wheat

than the above types. With these three wheats to choose from, farmers are ceasing to grow Ghurka, although this wheat has proved to be a great yielder in the Wimmera during the past decade.

The new wheat named Diadem (Ghurka × White Fife), which has grain of medium-strong flour quality, has given satisfactory yields at Longerenong, and is being grown on considerable areas of the Wimmera plains.

WIMMERA (red and fringe soils)

Compared with the black soils of the Wimmera, the red types are, generally speaking, not as fertile, and the wheat grown on them usually matures earlier. Under such conditions, varieties earlier than the Ghurka-Quadrat type are often more prolific, and, while in the past, Ranee 4H has been widely grown on the red loams, the new Mallee variety, Insignia, is likely to replace it.

Early wheats, however, will be out-yielded by the later types when good rains are received in the late spring. Bencubbin is also recommended for the red ground in the Wimmera, and is useful as a hay wheat owing to its taller straw. Regarding Pinnacle and Diadem on red soils, the evidence to date is insufficient to warrant a recommendation other than that they should be tried on limited areas.

The varieties recommended, therefore, for Wimmera (red and fringe soils) are :—

Quadrat, Magnet, Bencubbin, and, for trial, Pinnacle, Insignia, and Diadem.

MALLEE (Central and Southern)

Insignia, Bencubbin, Quadrat, Pindar, and, for trial, Diadem.

Insignia will probably become the principal Mallee wheat variety (in 1948 it occupied 25 per cent. of the area) and give highest yields, except possibly in a season with late spring rains. Bencubbin is also recommended as a suitable early type, despite its straw weakness.

In the southern Mallee, late-maturing wheats are more likely to succeed than in the northern Mallee, and both Pindar and Quadrat are therefore recommended, while Diadem is still under trial.

MALLEE (Northern)

Insignia, Bencubbin, Quadrat, and, for trial, Diadem.

In the northern Mallee areas, that is, north of a line drawn between Swan Hill and Ouyen, early-maturing varieties are likely to be the most successful, and the new wheat, Insignia, is strongly recommended for general sowing.

Bencubbin is a good early type, although rather weak in the straw.

In a good season, or if sown particularly early, a later-maturing type may be successful even in the northern Mallee, and Quadrat is recommended for such purposes, with Diadem worthy of trial.

MID-NORTHERN DISTRICT (west of Shepparton-Tocumwal railway line)

Insignia, Quadrat, Magnet, Bencubbin, and, for trial, Diadem and Pindar.

The normal rainfall in the Northern District increases sharply from the north-west to the south-east. In the drier sections, the early varieties such as Insignia and Bencubbin, are recommended along with the later types, Quadrat and Magnet, which are standard wheats for the higher rainfall districts of the Goulburn Valley. Diadem and Pindar are recommended for trial.

EAST-NORTHERN DISTRICT (east of Shepparton-Tocumwal railway line)

Quadrat, Magnet, Baldmin, Bencubbin, Insignia, and, for trial, Pinnacle, Pindar, and Diadem.

Whereas Ghurka was previously the main wheat in this east-northern area, it has now been replaced by Quadrat and Magnet, while Pinnacle, Pindar, and Diadem are being tried. Baldmin, a midseason type, has proved to be very prolific in the Dookie-Rutherglen section, its superior flour being an additional attribute. When earlier varieties are required, Bencubbin and Insignia appear to be the best available.

OTHER DISTRICTS (Western, Central, North-central, and Gippsland

Pinnacle, Quadrat, Insignia, Magnet (hay wheat), and Diadem for trial.

These areas usually experience good rainfall and rust often reduces yield. Of the recommended varieties, Quadrat has shown

a considerable field resistance to rust, although not immune. Magnet is a dual-purpose wheat, being more suitable for hay than the above three varieties, but rather susceptible to rust. The early-maturing variety, Insignia, is useful for late sowings.

NOTES ON THE MAIN VARIETIES

Pinnacle

This new variety, which was released in 1946, is a selection from Pindar. Pinnacle is a brown-chaffed, midseason variety, very similar in appearance to Ghurka, but slightly taller than that wheat. Like Ghurka and Quadrat, it is highly resistant to flag smut disease, and possesses good harvesting characteristics. In flour quality it is superior to Quadrat, Magnet, and Ghurka.

The production of Pinnacle marks a distinct advance in the objective of improving not only the prolificacy, but also the grain and flour quality of Victorian wheat.

Pinnacle is a very suitable variety for the Wimmera plains, since it has given better results than either Quadrat, Magnet, or Ghurka in six years of replicated tests at Longerenong and Salisbury. It is now the second most popular variety in the Wimmera.

Quadrat

Now the most popular variety in Victoria, Quadrat, a comparatively new wheat, has proved to be very prolific in the Wimmera and Northern Districts It was developed from a cross between Ghurka and C.M.G., and is a free-stripping, brown-chaffed wheat with a strong straw, only slightly taller than Ghurka. It has a bold head adding to its appearance. It has replaced Ghurka rapidly because of its consistent superiority in yield as demonstrated in experimental plots throughout the Wimmera. It is resistant to flag smut and partly resistant to rust.

Diadem

A midseason, white-chaffed variety of medium height, producing grain superior in flour quality to Ghurka, Quadrat, or Magnet, and classed as a medium-strong wheat. It is among the varieties recommended for sowing on black soils in the Wimmera, and is under trial in the other districts.

Insignia

This variety is now widely grown throughout the Mallee. It is the result of a cross between Ghurka and Ranee; was first distributed from the Mallee Research Station in 1946, and, in 1948, occupied 25 per cent. of the area sown.

Insignia is an early wheat, maturing a few days before Ranee 4H. It has a short, strong straw, slightly taller than Ghurka, and it stands better than most early types. Like Ghurka, it is resistant to flag smut, and is less susceptible to rust than Ranee 4H. It produces a semi-compact brown-chaffed head with short awns, and has proved easy to thresh at harvest without showing any tendency for the grain to crack.

Insignia normally produces a medium-sized grain, with flour at least equivalent in baking quality to its Ranee parent and superior to Ghurka and Quadrat. The evidence obtained to date with respect to its yielding ability in the Mallee proves it to be an outstanding variety.

Pindar

A selection from Ghurka, Pindar was the second most popular variety in the Mallee in 1946, and had then replaced Ghurka to a large extent. It is a distinct

improvement on that variety in both prolificacy and flour quality. Furthermore, its grain is larger and more attractive.

It is similar to Ghurka in disease resistance and field characteristics, except that it is slightly taller and a little earlier in maturity.

Regalia

An early-maturing wheat resembling Ranee 4H in most characters, but having a bolder head and darker chaff. It is more prolific than Ranee 4H, but is being supplanted by Insignia, although its taller straw may be an advantage under some conditions.

Bencubbin

Bencubbin is an early midseason, white-chaffed variety with medium to tall straw rather liable to lodge. It has given very satisfactory results in the sandy Mallee soils, and, in 1948, ranked third in popularity in Mallee districts. It has a large grain and the plant is almost immune from flag smut. It is useful as a hay wheat and is a good yielder on stubble ground.

Magnet

A late-maturing variety with a medium-tall, strong straw and white-chaffed heads, Magnet has good harvesting features but is rather tougher than Quadrat.

Although susceptible to rust and flag smut, it has given high yields in the Western Wimmera on both black and red land. Because of its late maturity it responds strongly to late rains, although the heads are often "tipped" by hot winds. Its longer straw makes it useful for cutting part of the crop for hay when required. Magnet is considered to be too late in maturity to be recommended as a suitable variety for the Mallee.

Ranee 4H

A selection from Ranee, Ranee 4H was a standard Mallee wheat for many years, and has also been popular on the red soils in the Wimmera and Northern districts where its early maturity and hardiness made it popular. It is susceptible to flag smut and rust, and is being replaced by other varieties, particularly Insignia.

Ghurka

For many years until 1946, Ghurka was the principal wheat variety grown in Victoria, and was notable for the fact that it was prolific in all districts of the State. Its main characteristics are its short straw, compact head, resistance to flag smut and rust, and hardiness in a drought. However, it is being displaced by the new varieties bred for specific districts, most of them having Ghurka as a parent.

Baldmin

This white-chaffed, medium-strong flour wheat has yielded well in the North-East despite the tendency of its straw to break during harvesting. It makes strong early growth which is an advantage where there is competition from weeds, as often occurs in the North-east. It is susceptible to flag smut.

B. HAY WHEATS

Bencubbin, Magnet, Warden, Wardfir, and Turvey

Very little wheat is sown in Victoria specifically for hay production, oats being preferred as a rotation crop, and recommended for this purpose. However, considerable areas of wheat are cut for hay annually from the wheat paddocks, mainly the "tracks" around fences and between blocks of crop left for stripping.

The taller-strawed varieties are usually the most suitable dual purpose (hay and grain) types, namely Bencubbin (for all Northern districts), and Magnet (for the Wimmera and North-east).

Warden, Wardfir, and Turvey are tall-strawed varieties particularly suitable for hay growing in Southern Victoria.

C. OATS

The main oat varieties in Victoria are Algerian and its improved selection, Algeribee. They are late-maturing types, and produce a grain very suitable for the oat-milling trade. They stool better than the early types and have proved very adaptable over a long period of years.

In Southern Victoria these varieties recover well after grazing and are, therefore, favoured by dairy farmers who sow the Algerian type in the early autumn, graze it until the spring, and then obtain a hay or grain crop following the normal spring rains. In the northern part of the State, particularly in the Mallee, spring rains often fail and earlier-maturing varieties then show to advantage, e.g., Mulga, Dawn, and Orient.

These early types also produce more winter feed than Algeribee or Algerian, particularly if sown thickly.

Orient, distributed from the Mallee Research Station in 1947, is a special purposes variety for grazing, giving early feed, and a good grain yield if allowed to recover in the spring. It is too short in the straw to be classed as suitable as a hay variety. Fulghum also is a useful variety specially suitable for grazing throughout the season, but is rather weak in the straw.

The choice of an oat variety, therefore, depends largely on the purpose for which it is required, the district and the place the variety fills in the general scheme of farm management.

The varieties recommended for the main districts are :—

WIMMERA, MALLEE, AND NORTHERN DISTRICTS

For general purposes :

Algeribee (if available), **Algerian, or Dawn.**

For early feed and early hay :

Dawn and **Mulga** (very early).

For grazing :

Orient, Fulghum.

SOUTHERN DISTRICTS

For general purposes :

Algeribee or **Algerian,** or **Dawn** if an earlier variety is required.

For spring sowing in very late districts :

Tartarian (white or black type).

D. BARLEY.

For malting :

Prior (all districts), Research (Southern and North-Eastern Districts), and Plumage Archer (late districts).

For feed :

Cape (all districts).

Note.—Detailed results of variety tests in the various districts are available on application.

Water for Poultry

A good water supply is essential for poultry. If water is restricted, the health of the birds will be affected, less food will be eaten, fewer eggs will be laid, and the growth of young stock will be retarded.

Drinking water shall always be available to ducks, both day and night. If these birds are deprived of water for even a short period they become very thirsty, and, when it is provided, will drink to excess, causing staggers or cramp, which may prove fatal.

A laying fowl will drink 5 or 6 oz. of water per day in normal weather, and much more in hot weather, therefore, after allowing for some wastage, provide approximately 1 gallon per day for every twenty birds.

Medicines or disinfectants should not be added to the water, as anything that makes it distasteful restricts the amount the birds will drink. This, in turn, will affect health and production. When medicines are necessary they should be given in the food. Clean the drinking vessels regularly, and, during hot weather, locate them in a cool place.

—[Contributed by the Live Stock Division.]

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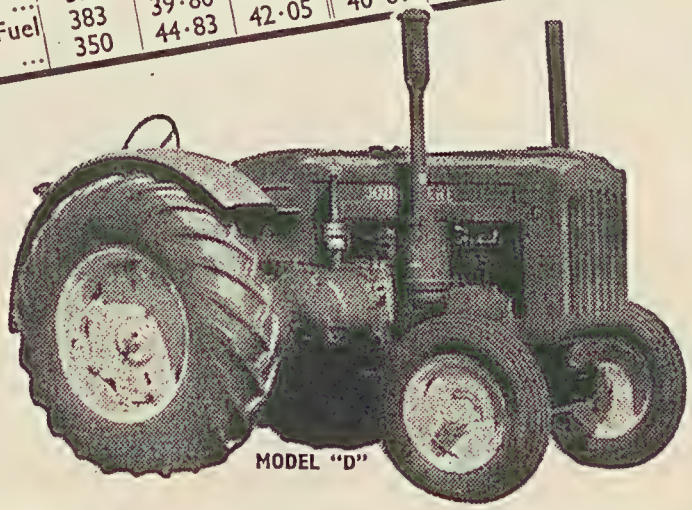
B-BN-BW-All Fuel	381	24·33	23·53	22·19	21·14	3689	1·33
AR-AO	378	30·94	30·33	27·13	26·52	4248	1·75
G-GN-GW-All Fuel	383	39·80	38·10	36·01	34·49	4394	2·07
D	350	44·83	42·05	40·61	38·02	4830	2·68



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Toxaemic Jaundice of Sheep

By A. R. Grayson, B.V.Sc., Senior Veterinary Officer

Lack of nutrition favours the onset of toxaemic jaundice, and a balanced pasture such as the one pictured is an effective control measure against the disease.

TOXAEMIC jaundice, or, as it is commonly called, "yellows" of sheep, is a condition which, in the past few years, has been, and still is, causing great concern to sheep owners in certain parts of Victoria. In some cases, mortalities amounting to more than 10 per cent. of the flock have occurred in outbreaks of this disease.

In Victoria, the condition appears to be confined to sheep of the British breeds and their crosses. Merinos rarely become affected. It occurs chiefly in ewes, but wethers and rams are also affected at times. Cases have not been observed in lambs or weaners, but thereafter the susceptibility appears to increase with age. Affected sheep are usually in good to fat condition.

There does not appear to be any particular set of seasonal conditions associated with the onset of the disease, losses having occurred under semi-drought conditions as well as on flush pastures at almost any period of the year. There is, however, usually a history which shows that, just prior to the onset of the disease, the sheep affected had been through a period of stress —frequently due to pregnancy and lactation, either associated with, or aggravated by, a change of pasture or by handling for treatment of some other condition, such as foot-rot.

The condition of stress which appears necessary for the onset of the disease is often brought about by lack of nutrition—either by overstocking or, more frequently, by unfavorable seasonal conditions. This is particularly so when ewes, which were in good to fat condition when joined, gradually fall away in condition as pregnancy advances, due for example, to a dry autumn and consequent lack of pasture. Under these conditions, the ewe, to meet the increasing demands caused by pregnancy and/or lactation, attempts to make use of the fat stored in its own body.

It would seem that the sheep is not well adapted to depend on its own fat for its energy requirements, and that the complicated mechanism of fat metabolism in the sheep brings about derangements in the normal liver functioning. As will be described later, this abnormal liver functioning results in the liberation of copper from the liver to the blood stream, and this liberation of copper is the immediate cause of the onset of jaundice symptoms.

SYMPTOMS

Most commonly the disease occurs in a hyper-acute form in which the sheep are visibly ill for a few hours only. This applies particularly at the onset of an outbreak. The affected sheep become separated from the flock and stand in a dejected manner with the head down. Pulse and respirations are rapid and the body temperature is usually high. The visible mucous membranes vary from a bright yellow to a muddy creamy colour, while the skin is also a muddy yellow colour. The wool pulls out very easily, and the urine is either red or reddish-brown in colour. The sheep become comatose and die in a few hours.

In the sub-acute form the affected animals exhibit symptoms for three or four days They cease feeding and stand about showing no inclination to follow the flock. The skin and mucous membranes are yellow. In some of these cases the symptoms persist for seven or eight days or even longer, and recovery gradually takes place. In these cases the skin and mucous membranes have a muddy yellow appearance; there is a considerable loss of body condition; diarrhoea is evident, and some weeks may elapse before the animal is normal.

The post-mortem appearances in the recently-dead state are quite typical. The subcutaneous tissues, all body fat, musculature, and all body organs are a distinctly yellow colour—varying in intensity from a bright yellow to a dull biscuit colour. There may be excess peri-cardial fluid in the peri-cardial sac and haemorrhages on both the outer and inner surfaces of the heart muscle.

The liver is friable and deeply jaundiced. The kidneys are somewhat enlarged, softened, and present the typical " gun-metal " appearance.

The small intestines are almost empty of contents, but the caecum is often congested and the contents are black and arranged in hard dry masses, coated with blood-stained mucous. The bladder is normal, but the contents vary in colour from coffee colour to bright red.

Putrefaction is rapid in sheep dead from this disease, and there is a characteristic offensive odour.

RESEARCH WORK

A considerable amount of research work into this disease condition in sheep has been carried out and is still continuing. Early work proved that enzootic jaundice is associated with a disturbance of the metabolism of copper within the sheep's body. It is known that normally the copper content of the sheep's liver, compared with that of other animals, is relatively high, and that, with increasing age, the storage of copper in the liver tends to increase. Under certain conditions which bring about abnormal liver functioning, this stored copper is mobilized and liberated into the blood stream, resulting in the breakdown of the red blood cells with consequent jaundice and haemoglobinuria.

Analyses of blood taken daily from sheep in field experiments have shown that this actually occurs, and the sudden rise in blood copper content, which may be of short duration, precedes and causes the onset of the jaundice. These experiments also showed that death invariably occurred when an acidosis developed in the sheep-excreting haemoglobin (the red colouring matter of the blood) in the urine. In those cases which recovered, or lived for some time after the onset of jaundice and haemoglobinuria, the urine remained neutral or slightly alkaline.

This naturally suggested that it might be possible to save some sheep which had developed jaundice by repeatedly drenching them with an alkaline mixture. Good results have been obtained by the use of frequent drenches—three to four times daily —of .2 oz. of bi-carbonate of soda dissolved in a few ounces of water. In an endeavour to maintain an alkaline reaction in the urine and so minimize the number of deaths from toxaemic jaundice, it is recommended that a supply of the following lick be made available to the sheep :—

	%
Common salt	50
Calcium carbonate	25
Sodium bi-carbonate	25

This early work strongly indicated the necessity for making a close study of copper assimilation by the sheep. Extensive studies along this line have been carried out in recent years by officers of the Council for Scientific and Industrial Research. As a result they have been able to show that the mineral molybdenum has an effect in reducing the copper status of sheep. They have shown that as acid soils depress the uptake of molybdenum and favour the uptake of copper by plants—that as changing climatic conditions at times favour a more acid state of the soil and at times favour herbage plants rather than grasses—that as certain species of herbage plants have a low avidity for molybdenum—and as the copper status of the sheep depends largely on the ratio of copper to molybdenum in its diet, when the molybdenum is relatively low in the pasture, a high copper status in the animal is favoured.

TREATMENT

In a recent bulletin issued by the Council for Scientific and Industrial Research the following recommendations to assist stock-owners to guard against the occurrence of enzootic jaundice in their flocks and, at least, to reduce its incidence, are made :—

(1) Maintain sheep if possible, on a pasture in which grasses predominate. Pasture management should be calculated to favour grasses in the pasture.

(2) In seasons with abundant autumn rains, sheep should not be grazed on clover-dominant pastures in those areas in which jaundice is known or suspected to occur. They can be grazed on clover with greater safety after the plant has flowered. The provision of a supplementary ration of dried hay, preferably oaten, is advisable.

(3) A salt lick containing molybdenum can be used with caution. Not all of the sheep will take the lick and some take more than is good for them. The lick need be used only through the summer and autumn. A suitable lick can be prepared by emptying a bag of salt—187 lb.—on to a mixing floor. Dissolve 10 oz. of ammonium molybdate in 2 gallons of pure water. Sprinkle the solution on the salt and mix thoroughly.

(4) When the flock has acquired a high copper status, deaths are precipitated by any nutritional strain and by exertion. Under these circumstances losses can be reduced by maintaining a reasonably high level of nutrition and by keeping the animals as quiet as possible. The importance of the maintenance of the plane of nutrition cannot be stressed too greatly. The provision of a supplementary ration, adequate both in quality and quantity is essential, and helps to control not only toxaemic jaundice but, also, other disease conditions of sheep.

HELIOTROPE POISONING

The investigational work on toxaemic jaundice of sheep has shown that the plant *Heliotropium europaeum* (Wild Heliotrope) contains substances which produce changes in the liver cells of sheep leading to severe liver damage and death of a number of sheep which have grazed the plant.

This plant is a summer annual which grows profusely in some northern areas of Victoria where summer rains are plentiful.

It is readily eaten by sheep when present in otherwise dry pasture. The toxic effect of the plant is considered to be due to the presence of alkaloids and is manifested by a progressive liver damage. Deaths may not occur for two or three months after the sheep have been ingesting heliotrope or until after the heliotrope has disappeared from the pasture. A number of deaths may then occur and other sheep in the flock may suffer a serious loss of condition. As some of the affected sheep show signs of jaundice, these deaths are often incorrectly ascribed to toxaemic jaundice.

Control

The one obvious control measure is to prevent sheep from grazing the plant. This is extremely difficult in those areas where the rainfall is insufficient for the establishment and maintenance of improved pastures, and where water for irrigation is not available, but which are subject in some years to summer rains.

Usually sheep will not eat Heliotrope if other green plants are available in the pasture. Therefore, a palatable and nutritious summer-growing annual, or perennial plant which would survive under the climatic conditions as successfully as the heliotrope, would do much to prevent the occurrence of heliotrope poisoning.

Alternatively, the provision of an adequate nutritious supplementary ration would limit the ingestion of heliotrope.

Burnley Egg-Laying Competition

Progress Totals—296 Days

The number of first-grade eggs laid to 21st January 1949, by the leading fowls in each class of the Burnley Egg-laying Competition, together with the names of the birds' owners, are set out in the following tables. The tests, which are being conducted at the School of Primary Agriculture and Horticulture, Swan-street, Burnley, commenced on 1st April, 1948, and will conclude on 2nd March, 1949, a period of 336 days. First-grade eggs, during the first two months of the competition, must weigh not less than 1¾ oz. and not less than 2 oz. thereafter.

Class 1.—White Leghorns—Wet Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
147	Hill, H. E.	270
142	Gibb's Highway Stud	261
146	Goddard and Harvey	261
128	Abikhair, Les	259
160	Lowe, G. R.	257
139	Bonview Poultry Farm	241
154	Sunridge Poultry Farm	240

Class 2.—White Leghorns—Dry Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
235	Skinner, A. A.	251
205	Clements, W. H.	249
229	Moran, G.	249
230	Moran, G.	244
231	Roberts, Miss A. E.	238
219	Johnson, A.	235

Class 3.—Light Breeds, other than White Leghorns—Wet Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
119	"Glenyuille" (Legbars)	209
104	Chalmers, H. L. (Legbars)	205
105	Doull, J. (Legbars)	202
102	Bruce, J. L. (Legbars)	198
120	"Glenyuille" (Legbars)	198
126	Woollett, C. J. (Legbars)	195

Class 4.—Australorps—Wet Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
31	Hanson, S. H.	241
4	Beswick, A. G.	234
7	Casper, A. and L.	234
10	Clark, F. A.	232
42	Sweeney, T. P.	232
11	Cumming, H. D.	231

Class 5.—Rhode Island Reds—Wet Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
89	Mills, J. J.	214
76	Fraser, D. R.	209
96	Wakeham, W. M.	201
63	Seven Acres Poultry Farm	198
98	Wear, J.	197
91	Perkins, A.	195

Class 6.—All Heavy Breeds, other than Rhode Island Reds and Australorps—Wet Mash.

Pen No.	Competitor.	Total First Grade. Eggs.
54	Cocking, W. (Light Sussex)	168
58	Lang, J. (Langshan)	143
56	Wilkinson Bros. (Light Sussex)	134
53	Cocking, W. (Light Sussex)	123

Dairy Supervisors' Examination

An examination for qualification as a dairy supervisor under the *Milk and Dairy Supervision Act* 1928, will be held in Melbourne commencing 8th March, 1949. Written, oral, and practical tests will be held. Candidates must present themselves at the Arts School, University of Melbourne, at 10 a.m. on the first day of the examination.

Entry forms, together with a fee of 5s., must be lodged, on or before the 28th February, 1949, with the Superintendent of Dairying, Department of Agriculture, Melbourne, C.2. Entry forms and syllabus are obtainable from the Superintendent of Dairying.

IN THE ORCHARD

By G. W. Gayford, B.Agr.Sc., Senior Horticultural Instructor

GREEN MANURE CROPS

FOR orchardists who are seeking to maintain their soil in a state of fertility the practice of regularly sowing a crop during the late summer for ploughing under in the spring can be well recommended. Now is the time to think about getting the crop sown, as early sowing is required to enable the crop to make good growth during the late summer and autumn. Crops sown after the end of March are rarely satisfactory except in the warmer districts.

A healthy growth of lupins grown for ploughing under as a green manure crop.

Although a green crop may not add much to the total quantity of organic matter in the soil, it provides a certain amount of material upon which the numerous beneficial soil organisms may feed and multiply. If the green crop material is of leguminous origin, when ploughed under it will add considerably to the total quantity of soil nitrogen and will not have an immediately depressing effect on soil nitrates such as would occur following the ploughing under of a material low in nitrogen.

Cereal crops have a low nitrogen content and are therefore not as valuable for green manure as plants such as field peas, tick beans or blue lupins. However, the seed of cereals is cheaper than legumes and cereals are favoured by many growers on this account.

Ryecorn is a good crop to grow in cold wet climates, and both oats and barley also produce satisfactory crops. Cereals and legumes are of equal value during their growing period in that they reduce surface run off and soil erosion during wet weather. This effect is particularly beneficial in the higher rainfall, hilly districts. Another virtue of a vigorous green crop lies in the removal by transpiration of a considerable quantity of soil moisture during the growing period.

This is a desirable feature in most orchards during the winter and may do much towards the prevention of soil waterlogging in the east zone of the trees.

Legumes such as peas, beans and lupins may be sown at the rate of 1½ bushels per acre and cereals at 1 bushel per acre.

Superphosphate at 2 cwt. per acre will be sufficient in most soils. In poor soils sulphate of ammonia 1 to 2 cwt. per acre will help the growth of cereal crops and on acid soils lime at the rate of 30 cwt. of slaked lime or 2 tons of ground limestone will also result in a considerably better growth of both legumes and cereals.

Growers may obtain more detailed information on this subject in the pamphlet, "Green Manuring in the Orchard," which is available free of charge on application to the Director, Department of Agriculture, Melbourne, C.2.

FRUIT-DROP PREVENTION

The use of sprays to prevent apples and pears from dropping off the trees just prior to the due picking date has now become almost universal among efficient orchardists. The sprays are sold under various commercial

names, but the active material in each is the same synthetic growth subtance, alpha naphthalene acetic acid. Most spectacular results have been on Williams' pears and Jonathan apples, both of which are liable to dropping.

The spray may be mixed quite safely with insecticidal sprays and it should be timed so that the trees will be covered five to ten days before tbe estimated picking period. The effective period varies, but, if applied at this time, the spray should protect the trees during the critical harvest period. The spray should be thoroughly applied so that the fruits, particularly at the stem end, will absorb the chemical.

Some orchardists and Jonathan apple growers in particular may be tempted to allow fruit to remain on the trees beyond the normal stage of picking maturity with the object of obtaining better colour development. This may not be a disadvantage where fruit is to be marketed immediately.

However, where the fruit is to be placed in cool storage, it is important that it should be picked just before full maturity, i.e., when the ground colour is changing from green to yellowish green. Jonathan apples picked beyond this stage will have a shorter life in cool storage.

CARE OF STONE FRUIT TREES

After crops have been harvested from cherry, apricot, plum and peach trees there is often a tendency to neglect these trees. It should be remembered, however, that, until leaf fall, the leaves are acting as factories producing starches and sugars which will be stored in the tree and used for production of fruit and shoot growth next season.

The trees should be irrigated during dry weather or, in non-irrigated districts, careful moisture conservation by weed control should be undertaken. Pests such as bryobia mite should be controlled by sprays of HETP and the pear and cherry slug with lead arsenate or DDT.

PRUNING OF BERRY FRUITS

The old canes of loganberries and raspberries which have borne the crop may be removed any time between now and late winter.

Early pruning has some advantage in that the new canes are allowed more room for development. The anthracnose leaf spot which seems to be increasingly evident on loganberries and septoria spot on boysenberries can be reduced by the early removal of old infected canes.

Suggestions by the Biological Branch of the Department for the control of these diseases include a spray of Bordeaux mixture, strength 4 : 4 : 40, immediately after harvest, a further spray a month later, and a spray of lime sulphur 1–20, just after growth commences, but before the leaflets are $\frac{3}{8}$ inch in length. Spacing out the canes in a fan-shaped trellis, rather than the usual method of roping them around a single wire would improve the control of leaf spotting.

Left : Raspberry bush before pruning. The old canes in centre bore the main crop last season. Right : After pruning, the old canes removed and seven of the strongest new canes left.

FRUIT PACKING

Growers are reminded that charts showing the correct methods of packing apples and pears are available free of charge. These, together with personal advice on packing methods, will be readily made available on application to the Department.

Rabbit Control Measures

Poisoning, Fumigation, Digging Out

By E. J. Pemberton, Superintendent, Vermin and Noxious Weeds Branch, Department of Lands and Survey

THE rabbit is Number 1 pest in Australia today, and it is the duty of all owners and occupiers of land throughout Victoria to destroy rabbits on their land and on the half-width of all roads adjoining their properties. This is obligatory under the Vermin and Noxious Weeds Act, which applies also to Shire Councils and other organizations.

During the past year the rabbit population has increased greatly and this may be attributed to several factors. The commercializing of rabbit skins and carcasses and the encouragement of trappers by landowners are two of the chief causes. Others are, the prevailing shortage of labour; difficulty of obtaining wirenetting and other essential fencing material; scarcity of poisons and fumigants; and, finally, a disinclination on the part of many landholders to undertake rabbit eradication if they can avoid it.

The trapper is attracted by high prices for winter skins, and realizes that to obtain the best returns he must produce good skins, which are those from the clean buck rabbit. He avoids the burrows and warrens where he would catch a big percentage of does and kittens. These are left to perpetuate the pest, and for this reason the rabbit population invariably shows an increase after the trapping season.

Material such as calcium cyanide, which is a product of dollar countries, is in short supply. A certain quantity is coming to hand, but citrus growers are being given priority. There is, however, an increased supply of Australian-produced bisulphide of carbon available, and this, if properly used, is most effective. Carbon monoxide gas-producers are also available.

Strychnine is in plentiful supply and phosphorous preparations are also available. **When using phosphorous preparations landholders should pay strict attention to the provisions of the Country Fire Authority Act.**

PROCLAMATION GAZETTED

A proclamation has been gazetted, and will be published in newspapers circulating in every rural district of the State, requiring all owners and occupiers of land on and after the 16th day of February, 1949, to destroy all rabbits on their land, which includes the half-widths of adjoining roads.

Inspectors stationed throughout Victoria have received instructions to strictly enforce the provisions of the Act. Government departments have been requested to deal with rabbits on land under their control, and unoccupied Crown lands will be dealt with wherever necessary.

Apples and strychnine accounted for this haul. Three "free feeds" were given before poison baits were laid.

CO-OPERATION OF LANDHOLDERS VITAL

The co-operation of all landholders is vital in this most important of seasonal operations. The remedy is in their hands and they should not permit themselves to be used as a means of furthering the prosperity of the trapper, the skin and fur buyer, and the exporter of skins and carcasses, all of whom wax rich at the expense of the primary producer. They should constantly bear in mind the fact that where rabbits are allowed to flourish production decreases and land values fall.

All rural organizations are demanding effective control of rabbits and every effort is being made to evolve new methods of destruction, but biological control has not yet proved effective in the field.

During the summer months rabbits poison easily and the time is now opportune to prepare an effective summer-poisoning campaign. This is best followed by fumigation or digging out of burrows and warrens, and the destruction of harbour. If this work is effectively carried out large numbers of breeding rabbits will be destroyed, pastures and crops will benefit, and farm returns will materially increase.

POISONING

Apples and Strychnine

Cut up the apples into baits about half to five-eighths of an inch square, dust with 1 oz. powdered strychnine to 12 to 14 lb. of apples, say, with a large-sized pepper castor. If brucine strychnine is used, however, 1 oz. of poison should be used to each 8 lb. of fruit.

Sugar in the proportion of about 1 lb. to 15 lb. of apples dusted on the bait is an additional attraction.

The advisability of "free feeding" *several times* beforehand cannot be too strongly recommended. In fact it is practically essential to success. The baits in "free feeding" should be similar in size to those which are poisoned and should be laid liberally in the trails. If the baits free from poison are well taken, success is certain.

The *poison* baits should be laid from about 18 inches to about 6 feet apart, according to the infested state of the land. One pound of apples should make about 250 to 300 baits, therefore an ounce of strychnine should do from 2,500 to 3,000 baits. The necessary length of the furrow required can thus be determined.

In places where there is only a small number of rabbits it is a good plan to peel the apples used in the actual poisoning (not necessarily with the "free baits"), as every side of the bait will then absorb poison.

In situations where furrows cannot be readily made, poison can be laid on scratches similar to those made when trapping. When poison is taken the furrow should be replenished until the rabbits cease to take it. It is better to err on the side of liberality than the opposite; far better to have some poison left in the furrows than to have a few rabbits left for future breeding.

If the poisoned baits are put down last thing at night, and looked at early the following morning, there is little danger to stock and bird life, and, under any circumstances, if the baits are laid right in the furrows stock are not likely to get at them.

Pears and quinces have been used as a substitute for apples, but apples are preferred.

Carrots and Strychnine

Act in exactly the same way as with apples excepting that, as the carrot is a dry bait, it is necessary to soak the baits for a while in sugar syrup; then drain off and use. Not only is the sugar an additional attraction, but it will hold and absorb the strychnine.

The bait is cut in squares for the following reason :—

The square bait offers a nice point for a bite no matter from what side the rabbit approaches it. The animal, therefore, is able to get a sizeable piece in its mouth at the first bite. That is all that is required for there is enough strychnine in that one bite to ensure death. The rabbit does not go away from the furrow, however, but will try other baits, until the poison does its work. That is why rabbits are nearly always found dead along the furrows.

Arsenic and Pollard

Dissolve 2 pints of treacle or honey, or 5 lb. of sugar, in 1 gallon of hot water and thoroughly mix 2 lb. of arsenic, 10 lb. of pollard and 2 lb. of bran in a revolving machine, churn, or in a dish or tub. Mix the arsenic, pollard, and bran with the sweetened water, stirring well all the time until the mass comes to the consistency of dough. When the mixture has been well kneaded, it can be distributed with a machine or laid by hand. If laid by hand it is a good plan to place a portion of the dough at a time on a clean board, first dusting the board with dry pollard and kneading it well, then roll it out until it is about one-third of an inch thick. Cut it into cubes with each face about one-third or half an inch square. Gather up the cubes into a box in which there is some dry pollard and lay in furrows a few feet apart.

Stock should not have access to poison trails.

Arsenic and Apples

Cut up about 12 lb. of apples into small cubes about half an inch in size. Spread on a sheet or bag, sprinkle enough sugar to make them adhesive, and work until all portions of the baits are sticky. A few teaspoons of sugar will be sufficient as too much will make a syrup.

Sprinkle ¾ lb. of arsenic through a shaker, working the sheet from corner to corner to mix poisons on baits thoroughly. The baits are then ready to lay about 2 feet apart in furrows that have been "free fed" for two nights previously.

Baits should be handled as little as possible. A spoon or a small piece of board is useful in removing baits from the bucket into the trail.

It is rarely that rabbits are found on the trail, as arsenic is a slow poison, and consequently skin values will be lost.

After using arsenic the hands should be washed with soap and water to which a small quantity of phenyle has been added.

FUMIGATION

Fumigation is undoubtedly a good form of rabbit destruction, especially in sand burrows, old wombat holes, under roots of trees, and in the banks of creeks and rivers. It is useful also in flat country which, at the time of flood, is liable to have water running over it. *The danger of erosion in such places when digging is resorted to is often great*, and can be greatly minimized by the use of the fumigator. It is an infinitely less expensive method than digging out.

As with digging out, a proper system must be employed in starting the work of fumigating an infested area. Men operating the plant must not be allowed to wander indiscriminately, but should begin the work at one end of the area and work right through,

This little chap looks innocent enough, but his looks belie him. Seven of his kind can eat as much as one sheep, and cause serious damage to soil and pasture.

Fumigating a warren.

being careful to check up the previous day's work before starting each day. Dogs are necessary to put rabbits under ground, for, if loose rabbits are left to harbor in logs, scrub, and other hiding places, burrows already fumigated will be easily opened up. In fumigating a burrow care should be taken to dig the mouth of the opening well back to solid ground, and when filled with gas the opening should be properly sealed. In sandy country it is a good plan to heap the filling in mounds. Where air pockets form in the burrows, it may be possible for a rabbit to escape the gas fumes. It will work its way to the mouth of the burrow and will have to scratch this filling away. In doing so the gas is agitated with deadly effects upon the rabbit. It is often found in examining burrows that one or more rabbits are found dead in the mouth of the burrow. Proper filling of burrows will often prevent opening from outside.

Several methods of fumigation are practised, namely, carbon monoxide gas, bisulphide of carbon gas, and cyanogas (calcium cyanide).

The Carbon Monoxide Method

Machines are available which produce carbon monoxide gas (C.O.), which no rabbit can survive for 30 seconds. Wood and water only are required in the production of this gas. A fire is lit in the generator, and when a substantial bed of compact charcoal has been formed, the engine or hand-blower is operated. This action forces the ordinary atmosphere through the burning mass of charcoal, which eliminates oxygen, leaving a mixture of nitrogen and carbon monoxide. This mixture passes over the water and is forced into the hose and introduced into the warren to be treated. The gas is generated quickly in large quantities and will be seen issuing from other inlets to the warren. These entrances should be closed with earth. There is no danger to the operator from this C.O. gas, as it breaks up immediately it makes contact with the open air.

Bisulphide of Carbon

Bisulphide of carbon is a highly inflammable liquid, and care must be exercised in its use. Men using this method must not smoke or allow bisulphide of carbon to come in contact with fire. A foolish practice has grown up, some men firing this gas. This is very dangerous and unnecessary; actually, firing destroys the effects of the gas, and must be discouraged. The approved method of using bisulphide of carbon is with a fumigator, several of which are available, and provision is made for using a smoke mixture composed of liquid ammonia and hydrochloric acid. Together with bisulphide of carbon, these machines are provided with taps enabling each mixture to be released as required. The main opening of the warren is selected for treating. This opening is dug back to solid ground and the outlet hose is inserted well into the burrow. The opening is properly sealed to prevent back flow of gas. Ammonia and hydrochloric acid is now pumped into the warren. This mixture forms a smoke which will emerge from any connected openings of the warren. Each opening is then sealed until no further smoke is seen. The smoke mixture tap is then turned off and the carbon tap turned on, and this material is then pumped until the burrow or warren is full of gas. When this is done the hose connection should be withdrawn and the opening properly sealed. All burrows and warrens are treated similarly.

An effective type of fumigator.

If a fumigator machine is not available, bisulphide of carbon can be used by pouring a small quantity on to any absorbent material, such as bagging, wool or dry cow dung. With this method each opening of the warren must be treated by inserting a piece of the treated material well into the opening of the burrow which has been dug back to solid ground. When treated, each opening is properly sealed. This method is wasteful, however, and not recommended.

Cyanogas (Calcium Cyanide)

Calcium cyanide is available in powder, flake, and granulated form.

Powder Cyanogas.—Burrows or warrens to be fumigated with cyanogas should be prepared as with other methods. Choose the main opening, dig back to solid ground, and insert the outlet hose into burrow or warren; if possible choose an opening in the direction the wind is blowing. Do not close the opening. Begin pumping alternately with gas cut off. First set machine in the "On" and then the "Off" position, close all openings from which dust is seen to emerge and continue blowing until all connected openings in the warren have been located and closed. Now close the opening around the hose and continue pumping dust into the warren for a few minutes; withdraw hose and properly seal the opening. Cyanogas in powder form must only be used when a blower is available.

Flake Cyanogas.—This material is used when a blower is not available. Each opening is dug back to solid ground and treated by using a long-handled ladle or spoon into which 1 oz. of flake cyanogas has been placed. This is then inserted full length into the burrow, poured out, and the ladle or spoon withdrawn and the burrow properly sealed.

Cyanogas quickly disintegrates when in contact with the atmosphere, and, being lighter than air, the gas rises quickly, and, if carelessly handled, may be inhaled by the operator with ill effects. The user may with extreme carelessness be asphyxiated. With the use of flake cyanogas, however, disintegration is not so rapid and the danger of hand using is not so great. Where any effects are noticed the antidote is liquid ammonia, which should be used as with smelling salts.

DIGGING OUT

While digging out appears to be a simple matter, apparently requiring no great skill, yet there are several points that may be emphasized. There is no doubt that digging out is an effective method of dealing with rabbits where it can be carried out, but, at the same time, it is one of the easiest jobs to slum by careless workmen. It is easy to miss little runs or side burrows. If, on inspection of the filled-in burrows the next day, any clean-cut holes with the soil scratched backwards are found, it will be realized that rabbits are being missed. No burrows or warrens should be left partly finished overnight. If so, nearly all the rabbits—except perhaps the little ones—will leave the burrow before next day. Any one who has had a perfectly secure wire-netting paddock dug out knows that the biggest catches are made in the last day or two. When a paddock is not netted, a good plan is to do a day's digging on, say, the north-east corner, the next day the south-east corner, and then the other corners and so on, putting in several days before coming back to the starting point. The rabbit is so suspicious that many will desert the burrows next to where the overnight work has been finished, but they will drift back again to those burrows when they find things are quiet again. By using this method all round a paddock and finally finishing with the central burrows, the best of results will be obtained. Even if the occupiers of these burrows are unsettled, they are less likely to leave because all the burrows round them have been disturbed and do not offer much harbor. This principle has been followed with much success. If a property is bad with rabbits, burrows and harbors, a good poisoning is recommended, to be followed by other means.

Burrows should not be left open after digging out, but should be levelled off, and if the time of the year suits, sown with grasses. This will destroy all signs of burrows and prevent soil erosion. Rabbits are unlikely to make fresh burrows in these places.

Good practical workers can fill in the greater portion of the burrows behind them as they go along, leaving little to do at the finish. On the other hand, if the open trenches and dirt heaps are left, a direct invitation is given to the rabbit to make a fresh start.

TUBERCLE-FREE HERDS

ACCREDITED TUBERCLE-FREE HERDS

The following herds have been declared free of tuberculosis under the *Accredited Tubercle-free Herd Scheme* conducted by the Department of Agriculture. Under this scheme a tubercle-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests or upon disclosure of infection, three semi-annual, successive, physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

Name.	Address.	Number in Herd.
Aboriginal Station	Lake Tyers	86
Ampt, E. W.	Gymbowen	12
Ampt, N. C.	Gymbowen	21
Ballarat Orphanage	Ballarat	139
Banyule Stud Pty. Ltd.	Wangaratta	55
Beggs, A. R.	Beaufort	116
Black, I. S., Estate of	Mount Noorat	64
Bleakley Bros.	Horsham	18
Bott, J.	Yarrawonga	70
Bruhn, C. H. and V. I.	Mirboo North	54
Candler, G. E.	Hamilton	35
Carne, W. J.	Pakenham Upper	30
Cason, J. M.	Lima South	63
Clark, W. J.	Monomeith	142
Cowan, G. L. S.	Bacchus Marsh	59
Cox, F. G.	"Birradale," S. Lyndhurst	47
Cribbes, T.	Wangaratta	40
Deering, J. T.	South Wangaratta	79
Dookie Agricultural College (Ayrshire Herd)	Dookie	117
Dookie Agricultural College (Hereford Herd)	Dookie	38
Drechsler, W. P.	"Berry Bank" Swan Hill	102
Eagle, W. H.	Womerah	31
Everist, F. R.	Tyabb	12
Fisher, A.	Boisdale	26
Foletta, G. G., and Son	Buxton	121
Geelong Grammar School	Corio	81
Gilbert, J. A. and R. D.	"Brockelbank," Yinnar South	108
Gilmour, D. W. and N. B.	"Yarravale," St. Hubert's-lane, Yering	121
Gleeson, P. J., and Son	Tynong	261
Gorman, A. W.	"Cathcart," Alexandra	57
Griffiths, J. G.	Benalla	121
Bross, Mrs. G. F.	Horsham	33
Hamilton, A.	Flinders	69
Henry, J. A.	Merrivale	40
Howlett, Mrs. G., and Miss E. Samuel	Lang Lang	84
Ivone, M., and Sons	Ovens	103
Jackson, H.	Lockington	81
Johnson, F. G.	Horsham	34
Jones, A. C.	Barnawatha	182
Keele, H. A.	Bamawm	79
Kelynack, P. T.	Bundoora	90
Kemp, E. J.	Horsham	16
Knglsey-Newell, F. J.	Shorcham	60
La Fontaine, G.	Mitta Mitta	61
Lawrence, P. H.	"Rainga," Tarrawarra	89
Lawton, W.	Frankston	56
Light, D. T.	Noradjuha	12
Longerenong Agricultural College	Dooen	49
Luke, K. G.	Romsey	32
Maloney, P. J.	Tongala	66
Maybery, A. H.	Mitre	13
Middleton, J. A.	Labertouche	80
Moore, J., and Co.	Yarram	109
Murray, M. G.	Lima	19
McIntosh, J.	Merrigum	44
McKenzie, A. E.	Kerang	54
McKenzie, Mrs. E. J.	Woodford	81
McKenzie, H. P.	Trawalla	15
McNabb, G. A., and Son	Irrewillipe East	196
Nancarrow Bros.	Kerang	56
Newton, J. M., and Sons	Whorouly	63
Nicholas, M. A.	Sherbrooke	79
Noonan, Mrs. S. A.	Benalla	68
Northcote Children's Farm	Bacchus Marsh	83
Onley, W. H.	"Glenholme," Caldermeade	88
Payne, A. E. T.	"Yarra View," Lilydale	78
Payne, T. E. N.	"Woodburn," Kilmore	72
Poole, M. A. and D.	Caldermeade	143
Poole, M. A. and D.	Yannathan	103
Potter, W. J.	Longwarry North	118
Price, L. E.	Ellerslie	78
Prosser, J. E.	Ondit	40
Read, exors., Estate I. D.	Springhurst	99
Rix, A. A.	Officer	79
Roe, Thomas H. P.	Cobram	15
Sanderson, R. F.	"Pleasant Hill," Kyneton	75
School of Horticulture	Burnley	9
Scott, A. L.	"Wolonga," Kongwak	43
Scott, F. E. Selwyn	Scotsburn	76
State Experiment Farm	Rutherglen	49
State Research Farm	Werribee	203
Stephens, Dr. F.	Vermont	34
St. Joseph's Home	Sebastopol	59
Thomas and Taylor Pty. Ltd.	Hamilton	26
Till, J. A.	Tongala	58
Tucker, E. G.	Horsham	72
Vagg, T. R.	Officedale	56
Vagg, F. G.	Leongatha	57
Variety Investments Pty. Ltd.	Woori Yallock	127
Warnock, J. A.	Lima South	77
Waterhouse and Son	Pakenham	67
Williamson Bros.	Carisbrook	119
Wilson, J. L.	Koo-wee-rup North	90

In addition to the above the following is a list of herds in their respective districts which have given negative reactions to two or more successive tests conducted by departmental veterinary officers, but, inasmuch as replacement cows are only submitted to one test before being admitted to the herds, they cannot be considered as accredited under the Accreditation Scheme which requires, among other things, that no cow shall be admitted to the herds unless it has given two (2) negative reactions at an interval of 60 days, and must be kept in isolation during the period between the two tests.

District.	Herds.	Cattle.
Ararat	11	291
Bairnsdale	4	109
Ballarat	122	3,050
Benalla	43	298
Bendigo	85	3,159
Broadmeadows	42	1,982
Colac	11	345
Doncaster	16	668
Geelong	101	3,692
Hamilton	2	94
Heidelberg	19	593
Horsham	9	468
Morwell	3	270
Orbost	1	99
Portland	7	431
Rutherglen	20	296
Sale	5	341
Terang	1	10
Traralgon	4	218
Wangaratta	38	475
Warrnambool	7	428
Whittlesea	105	4,485
Yallourn	4	269
Yarragon	36	1,630
Yea	26	73

There are also 418 herds in which 16,014 head of cattle have passed one test and may be considered, therefore, to be in process of becoming tubercle-free herds.

AN APPLE ON THE TREE IS WORTH
A BUSHEL ON THE GROUND

"CLING-SPRAY"

(Naphthalene Acetic Acid)

STOPS PREHARVEST DROP

Simply mix the contents of one 4 oz. bottle of "Cling-Spray" in 100 gallons of water, and spray in the normal manner when the first few of the maturing fruits are observed to fall.

Packed 24 by 4 oz. bottles per carton.

Price— 10/- per bottle plus freight.

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New South Wales Distributors:

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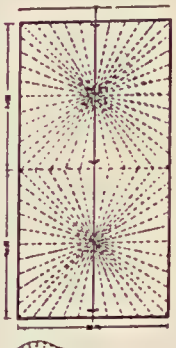
7-11 MARKET STREET, SYDNEY

The "WEBB-WAY" SPRAY
Makes Farming Pay



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Every drop of life-giving water bringing plant food from the air as it falls, in gentle rain, is worth real money . . . at any time . . . but particularly in dry spells or droughts, for it means luscious food in plenty—good crops that command high prices.

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"Webb-Way" pays for itself from the first day—and **now** is the time for you to install that first section on **your** farm. Examine its features—at No Cost or Obligation.

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W15/FP

PASTURE SEED CERTIFICATION

List of Growers and Registered Areas Approved for 1948-49 Season

Seed Certification Schemes are in operation in Victoria in respect to the following species and strains of pasture seeds : (1) Victorian Perennial Rye Grass ; (2) Victorian Phalaris Tuberosa ; (3) "Tallarook" Late Flowering Subterranean Clover ; (4) "Mt. Barker" Mid-season Flowering Subterranean Clover ; (5) "Bacchus Marsh" Early Flowering Subterranean Clover ; (6) Victorian Irrigation White Clover.

Growers with areas approved for 1948–49 are as follow :—

I. VICTORIAN PERENNIAL RYE GRASS

R.G.—
1. Pickford, A., Clunes.
6. Toose, H., Smeaton.
8. Smith, A. C., Learmonth.
9. Troup, G., Tourello.
10. Sewell, C. W., and Son, Kooroocheang.
11. Fenton, C. H., Coghill's Creek.
15. Wickham, T. B., Clunes.
16. Robinson, K., Clunes.
19. Pickford, C. A., Clunes.
20. Pickford, J., Jnr., Clunes.
22. Williams, A., Smeaton.
24. Evans, F. C., Smeaton.
27. McCrum. V. J., Smeaton.
30. Grieve, H. J., Smeaton.
31. Sewell, A. J. and D. H., Smeaton.
33. Toose, G. C. and A. W., Smeaton.
34. Clarkson, E. W., Tourello.
35. May, W. H., and Son, Smeaton.
43. Carter, Estate of J. R., Clunes.
44. Drife, G. R. H., Clunes.
47. Bunn, J., and Sons, Allendale.
50. Cook, W., Clunes.
52. Drife, T. W., Clunes.
53. Griffin, J. M., Coghill's Creek.
54. Hives, J. H., Kingston.
55. Muller, J. H., Smeaton.
69. McLennan, A. C., Clunes.
72. Ford, E. H., Tourello.
74. Redman Bros., Smeaton.
93. Luhrs, C. R., Wendouree.
102. Higgins, F., Irrewarra.
104. Currington, A. H., Warncoort.
107. England, S. C., Warncoort.
108. England, Mrs. G., Warncoort.
109. Hay, D. and G., Private Bag, Colac.
112. Hawtin, F., Colac West.
116. Kenny, P., Cororooke.
118. Martin, H. L., Irrewarra.
119. Menzel, C., Armytage.
125. Roache, J., Nalangil.
126. Roache, P., 23 Ligar-street, Colac.
128. Ryan, A., Private Bag, Colac.
132. Milne, R., Colac West.
134. Rankin, A., Colac West.
137. Small, A., Ondit.
138. McCready, D., Ondit.
140. Dignan, A., Warncoort.
142. McDonald, J. J., and Sons, Birregurra.
147. Mackay, D. G., Irrewarra.
148. Middleton, A. H., Nalangil.
154. Smith, S., Colac West.
160. Billing, F., Roadside, Colac.
167. Speirs, F. C., Private Bag, Colac.
169. Collins, G. J., Irrewarra.
172. Conheady, J., Nalangil.
173. Brien, A. J. and Sons, Birregurra.
181. Gubbins, N., Birregurra.
200. Elbourne, A. J., Irrewarra.
201. Bolton, M., Malmsbury.
202. Ward, A. H. and N., Box 31, Kyneton.
206. Hutcheson, S., Kyneton.
208. Keegan, L., 15 High-street, Kyneton.
210. Donovan, J., Malmsbury.
213. Thomson, G. H., Kyneton.
218. McPherson Bros., Mt. St. Mary-street, Kyneton
225. Trewhella, A. W., Newham.
227. Rollinson Bros., Green Hills, via Kyneton.
234. Henderson, C. L., Lauriston.
241. Rowe, L., Kyneton.
247. Curtin, J., Kyneton.
250. Halloran, J. J., Kyneton.
251. Buchholz, L., Lismore.
284. Calvert, N., Nerrin Nerrin.
297. Fitzgibbon, P., Mortlake.
307. Robinson, E. J., Kooroocheang.
313. Luhrs, C. and B., Wendouree.
318. Tennant, W. J. and V. J., Smeaton.
320. Mizzeni, Wm., Kooroocheang.
321. Gervasoni, N. A., Kooroocheang.
323. Irving, L., Miner's Rest.
325. Andean, W. M., and Son, Blampied.
332. Nicholls, P. L., Kooroocheang.
333. Charleson, Mrs. M., Kooroocheang.
336. White, L. and S., Alfredton.
345. Taylor, W., Kingston.
346. Charleson, E., Allendale.
348. Seamens, W., Koorocheang.
350. Mathews, A. M., and Son, Burumbeet.
355. Grieve, A. D., Blampied.
362. Philips, A. F. and B. T., c/o P.O., Alfredton.
406. Roache, D. J., Nalangil.
407. Menzel, A. A., Winchelsea.
437. Bourke, J. M., Private Bag, Colac.

438. Johnston, S. A., Birregurra.
443, Forrest, C. L., Estate, Irrewarra.
450. Champness, P. L., Mt. Moriac.
457. Inglis, J. T., Private Bag, Colac.
460. McRae, A., 87 Gravesend-street, Colac.
475. Wilson, Mrs. A. R., Private Bag, Colac.
485. Farquharson, W. G., Pennyroyal.
486. Ryan, F. P., Private Bag, Colac.
487. Higgins, J. J., Irrewarra.
491. Stanford, F. R. J., Tomahawk Creek.
492. Mackay, D. J., Warncoort.
511. Jeannes, E., Irrewarra.
512. Shelton, G. S., Irrewarra.
520. Gannon Bros., Muroon.
533. O'Shannessy, V., Cororooke.
541. Crabbe, C. F., Larpent.
549. Moran, J., Ondit.
550. Matthews, A. R. and R. H., Nalangil.
554. Johnson, F. H., Ricketts Marsh.
565. Lewis, A. A., Private Bag, Colac.
566. Pye, T., Bessiebelle.
567. McDonald, J. J., Birregurra.
568. Evans, C. P., Irrewarra.
569. Farquharson, W. G., Pennyroyal.
570. Stepnell, E., Conunnun.
571. O'Sullivan, P., Cororooke.
572. Parker, A., Colac.
574. Armestead, A., Irrewarra.
575. Downey, G. S., Irrewarra.
576. Burke, Mrs. J., Irrewarra.
577. McLennan, J., Nalangil.
602. Newnham, R. H., Newham.

2. VICTORIAN PHALARIS TUBEROSA

P.T.— 2. Larmour, R., Berrybank.
6. Cameron, E. H., Buangor.
9. Buchholz, L., Lismore.
10. Calvert, N., Nerrin Nerrin.
17. Champness, P. L., Mt. Moriac.
25. Schurmann, T., Mountajup.
26. Simpson, J. R., and Sons, Moyhu.
27. Edgar, O. W., Harrow.
29. James, A. T., Warrenbayne.
30. James, H. W., Warrenbayne.
31. McKinley, H., Tourello.
32. McQueen, J., Girgarre.
34. Dennis Bros., Warncoort.
37. Wilson, A. H., Beaconsfield.
38. Love, W. H., Narre Warren.
39. Ryan, Col. R. S., Berwick.
42. C.S.I.R., Parkville.
45. Dennis, J. V., Warncoort.
46. Carter, Estate J. V., Box 9, Clunes.
47. Toose, G. C. and A. W., Smeaton.
48. Millear, S. F., Willaura.
49. Fletcher, C. F., Buffalo River South.
50. Gibb, J. T., Moyhu.
51. O'Rourke, J. W., Eat., Thornton.
52. Learmonth, L. W., Coleraine.
54. Rogers, W. S., Skipton.
55. Calvert, W. J., P.B., Myrtleford.
56. May. J. L., Tooradin North.
57. Warman, S. T., Box 10, Cranbourne.
58. Wiedemann, G. N., Laceby, via Wangaratta.
60. Thomas, C., Apsley.
61. Walker, H. D., Myrtleford.
62. Skehan, R. T., Private Bag, Wangaratta.
63. McDonald, H. J., Moyhu.
64. Ahern, J. L., Rythdale.
65. Sewell, C. W. and Son, Kooroocheang.
66. Peterson, C. A. J., Rythdale.
67. Armytage, N. C., Casterton.
68. Gibson, D. I., Lismore.
69. Schurmann, E., Mountajup.
70. Small, M. J., Lilydale.
72. Burston, S., Casterton.
73. Schurmann, E., Mountajup.
74. Mathews, A. M., and Son, Burrumbeet.
75. Paxton, B., Tooradin.
76. McGregor, W., Box 117, Benalla.
77. Johnstone, B., Moyhu.
78. Hughes, J. H., Moyhu.
79. McPherson, R., Warrenbayne.
80. Johnstone, W. E., Moyhu.
81. Adams, D. C., Moyhu, P.B., Wangaratta.
82. Ross, Miss M., Docker.

3. TALLAROOK LATE FLOWERING STRAIN SUBTERRANEAN CLOVER

T.K.— 1. Head, E. C. L., Seymour.

4. MT. BARKER MID-SEASON FLOWERING STRAIN SUBTERRANEAN CLOVER

M.B.— 1. Neagle, A. E. and H., Private Bag, Naracoorte.
2. Thomas, C., Apsley.
4. McQueen, J., Girgarre.
6. Honey, W. H., Box 2, Wonthaggi.
7. Lee, W., Lismore.
8. Whitfield, C. T., Box 15, Beaufort.
9. Baker, J., Westmere.
10. Grey, H., Private Bag, Kerang.
11. Reichstein, R. W., Apsley.
12. Sims, A. L., Casterton.
14. Gardiner, J. A., Lake Mundi.
15. Gibson, D. S., Lismore.
16. Koch, L. T., Wando Dale, via Colerine.
17. Kirkpatrick Bros., Beaufort.
18. Smith, N. R., Lang Koop.
19. Smith, F. S. M., Lang Koop.
20. Ruth, P. J., Apsley.
21. McQueen, R., Girgarre.

5. BACCHUS MARSH EARLY FLOWERING STRAIN SUBTERRANEAN CLOVER

B.M.—1. Toose, G. C. and A. W., Smeaton.
2. Redman, G., Smeaton.
4. Koch, L. T., Wando Dale, via Coleraine.
6. Kennedy, E. F., Arcadia.
7. McQueen, R., Girgarre.

6. VICTORIAN IRRIGATION WHITE CLOVER

I.W.— 1. Watson, J., Dingee.
2. Hamley, H. J., Dingee.
3. Jackman, J. W., Dingee.
7. McEwen, J., Stanhope.
13. Bullingham, J., Tongala.
27. Lindsay, R. N., Tongala.
29. Hamley, E. R. and H. J., Dingee.
31. Kerr, R., Toolamba.
32. Grey, H., Private Bag, Kerang.
33. Spence, J. A., and Co., Dingee.
35. Thomas, L. R., Undera.

LIVE STOCK NOTES

Compiled by A. C. T. HEWITT, M.Agr.Sc.,
Live Stock Science Officer

PIGS REQUIRE GREEN FOOD

UNTHRIFTINESS in pigs, including infertility of sows and boars, pigs born dead, small or weak, slow growth in young pigs, unhealthy skin conditions, and pneumonia are often the consequence of an inadequate supply of green food or a suitable substitute in the pigs' diet.

Green food will not usually replace a large part of the grain, milk, or other foods in the diet of pigs, but it does supply the accessories which are deficient in these ingredients.

An ample supply of green food should be considered as an insurance against unthriftiness of pigs and provision should be made to supply pigs either with green pasture, forage crops, green lucerne, clover, or meadow hay. In cases where it is not practicable to provide such foods, manufactured fish-liver oil emulsion may be used to supply vitamin A which is probably the most valuable and essential nutrient provided by green foods.

Pigs have the ability to store vitamin A and other essential nutrients in their bodies for a considerable period, and this sometimes leads pig raisers into a state of false security. When, after a long period without green food, the breeding or growth of the pigs becomes unsatisfactory, owners are disinclined to believe that lack of green food was the primary cause of the trouble. They argue that the pigs were without green food for months before anything went amiss, and, therefore do not associate the symptoms with the lack of green food.

Now that pastures are dry, some green hay or chaffed lucerne, clover or meadow hay can be given to pigs with good results.

Where it is practicable to grow a small plot of irrigated lucerne near the piggery, it will be found useful for scything and feeding to the pigs.

[L. A. DOWNEY, H.D.A., Pig Expert.]

Berkshire pigs on clover.

PURE-BRED BULL DISTRIBUTION PLAN

The purpose of the Pure-bred Bull Distribution Plan is the improvement of dairy herds by the introduction of pure-bred bulls to the herds of dairy farmers who are unable to bear the full expense of such bulls. The Department of Agriculture will purchase approved bulls from breeders whose herds are under Government Herd Test and will allot them to approved applicants who pay half the purchase price. This price is determined by the butterfat record of the bull's dam and the age of the bull.

The purchaser contracts to keep the bull for three years, by which time the Department automatically transfers all interest in the animal to the purchaser. During this three-year period, the purchaser is obliged to report any sickness, injury, or death of the bull and is liable for the payment of the other half of the purchase price if the bull is sold.

At present the dairy farmers obtaining most of the bulls distributed under the plan are returned soldiers who are taking up dairy farming.

For the six months prior to New Year, 100 bulls were distributed. These included 75 Jerseys, 6 Friesians, 6 red polls, 4

Australian Illawarra shorthorns, 4 dairy shorthorns, 3 Ayrshires, and 2 Guernseys. Full particulars concerning the plan may be obtained from the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2. [A.C.T.H.]

AVERAGE PRODUCTION OF DIFFERENT BREEDS OF DAIRY CATTLE

Average production of the various breeds of pure-bred cows under Standard Herd Test provides some interesting information and shows what a big part the Jersey breed plays in the dairying industry. Over 71 per cent. of all cows tested were Jerseys, and these produced an average of 356 lb. of butterfat.

Breed of Cow.	Number Tested.	Average Butterfat Production.
		lb.
Friesian	197	369
Guernsey	204	365
Jersey	3,546	356
Red Poll	145	330
Dairy Shorthorn	332	291
Australian Illawarra Shorthorn	194	287
Ayrshire	357	283
Total	4,975	
Average for all breeds ..		343

[A.C.T.H.]

LONDON DAIRY SHOW

The 62nd London Dairy Show held at the end of October was one of the most successful ever held. There were 784 entries and 330 animals were exhibited. These animals represented eight breeds—British Friesians, Ayrshires, Dairy Shorthorns, Red Polls, Jerseys, Guernseys, South Devons, Kerries, and Dexters.

The Show was a triumph for Friesians, just as the 1947 Show was a triumph for Ayrshires. Many records were broken in that two Friesian cows produced over 10 gallons of milk in the 24 hours during the Show; an Ayrshire produced slightly more than 9½ gallons and a Kerry cow gave a record yield for this breed of over 6 gallons.

The Supreme Champion was the British Friesian, Lavenham Chancery 22nd, bred and exhibited by Messrs. Strutt and Parker (Farms) Ltd. The Reserve was awarded to Messrs. A. Barclay and Sons' Ayrshire, Barclay Doris 2nd. The total production of these cows was high. They were milked three times a day and Lavenham Chancery 22nd produced 101·1 lb. of milk with tests of 3·86, 4·24, and 3·87 per cent. at the morning, afternoon, and evening milkings. Barclay Doris 2nd produced 96·7 lb. milk with tests of 4·44, 3·83, and 4·46 per cent. respectively.

The Show is conducted by the British Dairy Farmers' Association, and thousands of people pay 10s. to see the cattle judged. Points are allotted for type, but, for the high producers, any loss of points for type is usually insufficient to unplace them. Naturally, all of the cattle entered are of good general conformation.

[A.C.T.H.]

GOAT TESTING IN N.S.W.

The New South Wales Department of Agriculture has issued the first report on the production recording of pure-bred goats. The does are officially recorded in the same manner as cows, except that production standards are lower and additional age classes for junior and senior yearlings (one-year-olds) are provided.

The report covers three years and, in the first year (1945–46), 30 does produced an average of 1,872 lb. milk with 4·2 per cent. test and 79 lb. butterfat. In 1946–47, 16 does averaged 1,852 lb. milk, with a 4·6 per cent. test and 85 lb. butterfat, and, in 1947–48, the 13 does to complete 273 days' lactation periods averaged 2,087 lb. milk with a 4·4 per cent. test and 91 lb. butterfat.

The two outstanding does tested over this period were Radiance, 2,888 lb. milk, 4·7 per cent. test, and 136 lb. butterfat as a junior three-year-old in 1945–46 and entered by Mr. A. T. Gregory, Bankstown, N.S.W.; and Bonnie Nell, a junior two-year-old with 2,668 lb. milk, 4·9 per cent. test, and 131 lb. butterfat, entered by Mr. O. Tinson, Punchbowl, N.S.W. in 1947–48. The highest milk producer was Carinya Mimi, entered by Mrs. Y. Gardner, Sutherland, N.S.W., with 3,110 lb. milk, 3·9 per cent. test, and 123 lb. butterfat as a junior four-year-old. All records are for 273 days.

[A.C.T.H.]

COLICS IN THE HORSE

The term colic can be applied to a number of disorders in horses in which the most noticeable symptom is abdominal pain. Common causes of colic are :—

1. Errors of diet or overloading of the digestive system such as is likely to occur in horses fed full rations over a rest period.

2. Working horses heavily on a full stomach.

3. Feeding after work without previously allowing the horse to drink.

4. Sudden changes of diet, such as bringing horses straight from grass on to a hard ration.

5. Eating foreign material such as sand—prevalent in the Mallee wheat-growing areas.

6. Bad teeth which cannot properly chew the food and are, therefore, a cause of indigestion.

7. Eating large quantities of wheat.

8. Watering thirsty horses after they have been fed.

A form known as spasmodic colic, due to contraction of a section of the bowel, may arise from the sudden shock of mouldy or imperfectly chewed food, or cold water on the stomach or small gut. The pain may develop suddenly, and be fairly severe. It may disappear quickly, but the animal often has recurrent attacks. Breathing is accelerated and profuse sweating occurs. The horse gets up and down frequently. When standing, it stretches and strains as if attempting to pass urine.

The following drench should be administered when the symptoms are first noticed :—

Raw linseed oil, 1 pint ; oil of turpentine, 2 oz. ; aromatic spirits of ammonia, 2 oz. ; tincture of nux vomica, ½ to 1 oz.

This drench may be followed up in an hour or two by a drench consisting of aromatic spirits of ammonia, 2 oz. ; sweet spirits of nitre, 1 oz. ; water, ½ pint.

The horse should be kept as comfortable and warm as possible to avoid injuries and chills.

Impaction colic may occur from overeating and this is accompanied by dull pain. The patient is listless and uneasy, and it may lie down in an attempt to relieve the pain. The head is turned towards the flank.

Following an impaction of the lower bowel, fermentation of food, resulting in accumulation of gas causes an attack of flatulent colic. The horse goes down and rolls and breathing is accelerated. The distension of the bowel may become evident, usually at the off flank. A recommended treatment for this complaint is a drench of 1 to 1½ pints raw linseed oil and 2 oz. oil of turpentine. Copious enemas of warm, soapy water should be given frequently.

[J. Eckel, B.V.Sc., Veterinary Officer.]

BEEKEEPING

The Victorian honey flow has been very erratic this season, and autumn prospects in most parts of the State are not encouraging.

Good spring flows of honey were gathered in some districts, and the area round Balmoral, Edenhope, and Harrow proved to be the best, while Yellow Gum in the Maryborough and Rushworth districts yielded up to two tins per hive.

Red Gum in many parts of the Western District dropped its bud during October, and put on new growth instead of blossom.

Weather conditions during the most of the summer were so bad that bees were prevented from working the bloom adequately, but many bees will be moved into irrigation and clover areas this month.

Some Brown Stringy Bark is available with Apple Box in southern parts of the Western District.

Apiarists would be wise to conserve stores on hand as the autumn prospects in most parts of the State are poor.

[W. A. Collins, Apiary Inspector.]

OATS, A VALUABLE POULTRY FOOD

In view of the recent substantial increase in the prices of bran, pollard, and wheat, and the ease of procuring oats, poultry farmers are naturally anxious to use additional quantities of this cereal.

Poultry feeding tests conducted at the State Research Farm, Werribee, have shown that oats may be used as a complete grain ration for laying fowls, and a brief summary of the tests is given in the table on the next page.

Conclusions

The tests have shown that oats may be used as a complete grain ration for laying fowls. The slightly lower production in the pens where oats were fed may lend support to the theory that the difference in food value between oats and wheat is equivalent to the amount of husk contained in the oats. The excellent results obtained in Control Pens Nos. 3 and 8 are probably due to variety in the ration obtained by feeding mixed grains.

The outstanding performance of the birds in No. 4 pen, fed wheat only, is not supported by the other groups fed on a similar ration. Such performances are not unusual in feeding tests, and it is quite possible that many high-producing pullets were grouped together in this particular pen.

One interesting feature was the regular amount of food consumed in all pens. The theory concerning the unpalatability of oats is not borne out in these tests, as the difference in the consumption of wheat and oats is negligible.

A good quality oat was fed throughout the tests. This appears to be an important factor in the feeding of oats to poultry.

Although the tests have shown that oats may be used as a complete grain ration for laying hens, the process of changing over may take some time, and, therefore, a more direct approach could be made by gradually increasing the amount of oats in the grain ration to 50 per cent. and add up to 30 per cent. of crushed oats to the mash.

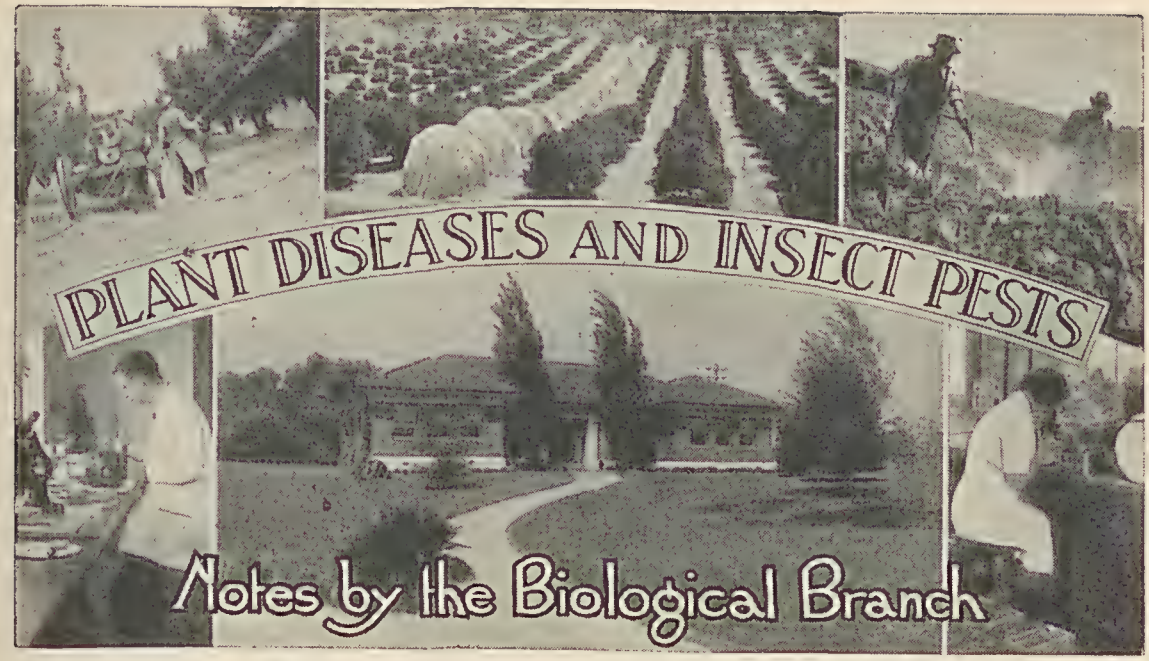
The quality of oats should not be less than 32 lb. to the bushel.

POULTRY FEEDING TESTS—STATE RESEARCH FARM, WERRIBEE

Pen Number.	Fifty Birds Per Pen.	System of Feeding.	Average Amount of Food Consumed Per Bird.	Average Number of Eggs Laid Per Bird.
			lb.	
1	Australorps ..	Dry mash in hopper; free choice wheat in hopper; greenfeed	95·6	172·2
2	Australorps ..	Dry mash in hopper; free choice oats in hopper; greenfeed	95·2	163·6
3	Australorps ..	Control pen—dry mash in hopper; mixed grain in litter; greenfeed	96·3	188·0
4	Australorps ..	Wet mash; free choice wheat in hopper; greenfeed ..	96·1	208·7
5	Australorps ..	Wet mash; free choice oats in hopper; greenfeed ..	96·1	184·8
6	White Leghorns	Wet mash; free choice wheat in hopper; greenfeed ..	96·4	185·4
7	White Leghorns	Wet mash; free choice oats in hopper; greenfeed ..	95·9	178·4
8	White Leghorns	Control pen—dry mash in hopper; mixed grain in litter; greenfeed	95·8	184·5
9	White Leghorns	Dry mash in hopper; free choice wheat in hopper; greenfeed	96·6	171·2
10	White Leghorns	Dry mash in hopper; free choice oats in hopper; greenfeed	94·2	162·2

The mash fed in all the pens consisted of 30 lb. bran, 60 lb. pollard, 10 lb. meatmeal.

[M. D. HALL, Poultry Expert.]



"BLACK SPOT" OF PEARS

BLACK Spot of pears is caused by the fungus *Venturia pirina*. This fungus is a distinct species from that which causes black spot on the apple and which is known as *V. inaequalis*.

Symptoms

The black spot fungus can attack the young wood as well as the leaves and fruits of the pear. Leaves develop obvious, more or less sooty, black patches; fruits develop small, or large, sooty black spots, with the centres of the larger fruit lesions ultimately becoming dry, corky, and devoid of spores, and the margins of the lesions showing a continuous narrow band of blackish, spore-producing, tissue.

Badly affected fruits become much distorted, and misshapen, as the invaded portions of the fruit slacken in their relative rate of growth, or cease to grow altogether, while the uninjured areas continue to grow normally.

Much of the fruit falls prematurely, if attacked by the trouble while young, on the fruit stalk, and a considerable amount of fruit which remains on the tree may become badly cracked and fissured, with hard dry "scabs" (whence is derived the name "black spot" or "scab"). Such fruit is altogether worthless for market.

The lesions on the fruits are, in all cases, only skin deep and can be easily peeled away, leaving uninjured tissues below.

Control

Control falls under two main headings: Sanitation and Spraying.

Sanitation involves, wherever possible, the gathering and destruction by fire or deep burial, of as many of the fallen leaves as possible, in the autumn or before any signs of "bud bursting" occur in the trees in the spring.

In commercial orchards, it is advantageous to plant a quick-growing cover crop in the autumn to hold the fallen leaves and plough this in early, in the spring, before any signs of bud bursting are seen. No further cultivations should be given until well after fruit-setting and until hot dry weather occurs. In any case they should be shallower than the ploughing to avoid the danger of bringing the dead leaves to the surface.

The reason for the above is that the fungus does not die when the leaves die, but penetrates into the interior and there produces its over-wintering-stage spores, the *ascospores* of the *Venturia* stage, which are ejected from the flask-shaped structures containing them during moist weather, approximately simultaneously with "bud-burst" and later stages of development of the trees.

Fig. 1.—Left: The "delayed green tip" stage of pears. Right: Pear blossoms showing finger stage of fruit-bud development.

In moist weather these spores set up the primary infections, from which the *Fusicladium*, or summer-spore stage of the fungus is soon developed. This last-named fungus gives to the infected tissue its characteristic sooty-black appearance.

The pruning out of any infected young wood which may be showing the *Fusicladium* pustules, and its destruction, constitutes a further sanitary measure designed to reduce the abundance of the "spore load" in the spring.

Spray Programme

The various stages of growth at which sprays are applied are as follow:—

Delayed Green tip—When the maximum number of blossom buds have brown scales (bracts) separating and tips of green folded leaves are just visible. (Fig. 1).

Finger—When green leaves are separated from blossom buds which are beginning to separate in the cluster, *but before white petals appear.* (Note.—Odd blossoms only may be showing white petals.) If a 6 : 4 : 40 Bordeaux mixture spray is applied later than this stage, russet may occur. (Fig. 2.)

Late Calyx—About three weeks *after* the fruit has formed.

Detailed spray Schedules for Individual Varieties to prevent spray Russet

WILLIAMS', BEURRE BOSC:

(1) At "Delayed Green Tip" stage apply Bordeaux mixture 6 : 4 : 40.

(2) At "Finger" stage apply Bordeaux mixture 6 : 4 : 40.

(3) At "Late Calyx" stage apply Bordeaux mixture 3 : 3 : 50.

(This may be used in combination with the arsenate of lead spray.)

JOSEPHINE AND WINTER COLE:

Only one Bordeaux mixture spray (6 : 4 : 40) should be applied, and this will be at an early *green tip* stage. This stage is slightly earlier than that described above as "delayed green tip". Any further Bordeaux mixture sprays will russet these varieties.

WINTER NELIS AND MADAME COLE:

(1) At "delayed green tip" stage apply Bordeaux mixture 6 : 4 : 40.

(2) At "Finger" stage apply Bordeaux mixture 6 : 4 : 40.

(This application *must be completed before any petals* show pink.)

(3) At "Late Calyx" stage apply Bordeaux mixture 3 : 3 : 50.

This spray *must not be applied within three weeks after petal fall.*

(This spray may be combined with the arsenate of lead spray.)

PACKHAM'S AND OTHER CLEAN-SKINNED VARIETIES:

(1) At "delayed green tip" stage apply Bordeaux mixture 6 : 4 : 40.

(2) At "Finger" stage apply Bordeaux mixture 6 : 4 : 40.

(3) At "late calyx" apply Bordeaux mixture 1 : 1 : 50.

(This may be combined with the arsenate of lead spray.)

Control of Summer Spot

Infection late in the season arises from primary infection caused in the early spring. If spring spraying is efficiently carried out little trouble need be expected from summer spot in normal years, and provided the proper spray schedules have been consistently followed, as routines, year after year. If summer black spot does appear, a Bordeaux mixture 1 : 1 : 50 can be applied, either alone or combined with an arsenate of lead spray, to Williams', Bosc, and Packham.

Fig. 2.—Black spot of pears showing leaf lesions.

For *Josephine*, 6 oz. bluestone and 6 oz. freshly-slaked lime can be added to 80 gallons of arsenate of lead spray, for the control of summer spot.

Bordeaux mixture of strength 6 : 4 :40, contains 6 lb. of copper sulphate, 4 lb. of burnt (unslaked) lime. If hydrated lime is used, the 6 : 4 : 40 formula becomes 6 : 6 : 40, the 3 : 3 : 50 becomes 3 : 4½ : 50, and the 1 : 1 : 50 becomes 1 : 1½ : 50. The last figure in all cases means gallons of water.

Preparation of Bordeaux Mixture

The Bordeaux mixture used at "delayed green tip," and considered here as an example is known as Bordeaux 6 : 4 : 40. The first figure in the formula refers to the quantity of copper sulphate (bluestone) in pounds, the second figure to the amount of quick-lime in pounds (if fresh, water-slaked lime is used half as much again is required) and the third figure to the amount of water in gallons.

If a small quantity of Bordeaux spray of 6 : 4 : 40 strength is required (e.g., 10 gallons), it is made up as follows :—

Dissolve 1½ lb. of copper sulphate (the small crystalline form known as "bluestone 'fines,' 'neige' or 'snow'" dissolves more readily) in 5 gallons of water in a non-metallic vessel. In another vessel dissolve either 1½ lb. of fresh, water-slaked lime, or 1 lb. of quicklime, in another 5 gallons of water. Then mix the two solutions together by pouring them simultaneously into a third non-metallic vessel. The mixture, which should be sky-blue in colour, may then be put into a bucket pump, provided it is sprayed out immediately.

To prepare a large quantity (e.g., 80 gallons) dissolve 12 lb. of finely-crystalline copper sulphate in 72 gallons of water in a spray vat. Then mix 12 lb. of slaked lime with 8 gallons of water, start the agitators on the vat, and slowly pour the "milk of lime" suspension into the vat, making sure that *all* the lime sediment is incorporated.

Air-slaked lime is useless for making Bordeaux mixture; fresh, water-slaked (i.e. hydrated) or quick-lime alone are permissible.

Fig. 3.—Black spot of Winter Cole pears, showing characteristic lesions on the fruits.

BULB EELWORM

Probably the most destructive disease of the Narcissus, and related plants, is that caused by the bulb eelworm, *Anguillulina dipsaci*. This disease has spread rapidly in the last few years due to the ease with which infected bulbs are transported from one area to another in the ordinary course of commerce. For this reason all highly-priced imported or locally purchased bulbs should be ordered and accepted only on the basis of a certificate that they have come from clean stocks or have been hot-water treated at the farm of origin. Even then it is advisable to plant new stock in an isolated part of the garden, which may be regarded as a " quarantine " area.

Section through bulb showing rings of decayed tissue associated with eelworm attack.

Symptoms

The first symptoms of the disease generally occur in the foliage, in the form of small lumps or blisters which have been called " spikkels ". They occur on both surfaces of the leaves and are generally felt when such leaves are drawn between the fingers.

In more severe cases the leaves and flower stalks become thickened and distorted.

They are also often strongly yellow in colour or show deep yellow stripes, and often die when only a few inches above the ground, the bulb frequently dying out or shrivelling badly by the end of the season.

If flowers are produced in such plants, they are usually late and may be ill-formed. Recently-infected bulbs frequently show no external signs of attack, but, when cut across, such bulbs show more or less concentric rings of discolored tissue in which the worms occur.

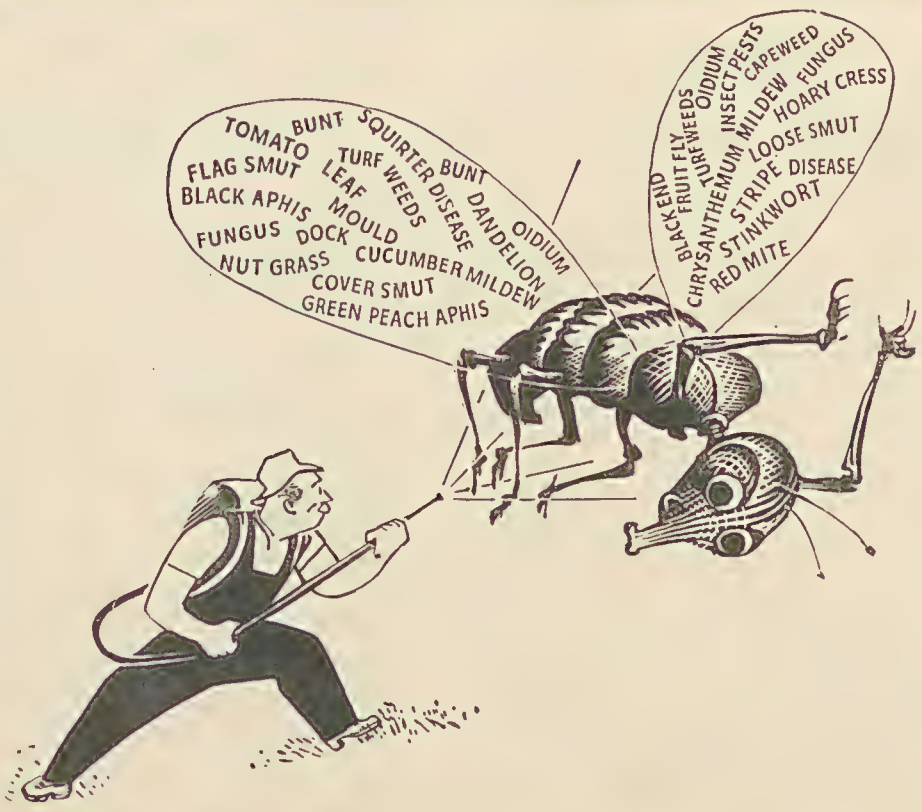
Causal Organism

Migration of the causative eelworms takes place from infected to healthy bulbs during the growing season and is assisted by the movement of running surface water. The adult eelworm, *Anguillulina dipsaci* is very small, being approximately 1/25″ in length.

It attacks many ornamental plants, field crops and weeds, but there are numerous different strains of this eelworm, any one of which is restricted to its own limited host range and cannot infect the hosts of another strain. Thus the strain which occurs on the narcissus cannot infect the hyacinth, and vice versa. However, the narcissus strain can attack onions and bulbous irises as well as certain weeds including various species of rib grass.

During the larval stage the worms may coil up like a watch spring, and while in this condition are very resistant to drying. Thus the parasite is able to persist in a viable condition for relatively long periods in stored bulbs or on crates or bags used for that purpose.

Typical "spikkels" caused by Stem and Bulb Eelworm on narcissus foliage.
[*After Min. Agr. & Fish.*



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Control

During the growing period any plants which show symptoms of eelworm attack should be pulled out, the sites from which infected bulbs are removed being disinfected with formalin, 1 pint to 7 pints of water.

Where land is plentiful and long rotations feasible, field roguing is not so imperative as is the case with small areas. All bulbs which are reasonably suspect should be treated, when thoroughly dormant, with the "hot water" treatment, for three hours, with water containing 1 pint of commercial formalin to every 25 gallons of water, at 110°F.

Early digging to reduce contamination towards the end of the growing period, plus the burning of all soft or rotten bulbs should be practised.

In all stages of handling infected bulbs, sanitary measures to prevent contamination of healthy stock should be taken. Kerosene washes are very effective for tools and crates and storage tables.

Finally as mentioned earlier, all precautions should be taken with newly purchased stock, to prevent the disease being introduced into clean areas.

ANTS

A common garden and household pest, ants may be troublesome at any season of the year, but are more active during the spring and summer months. With the exception of the Argentine ant, most species of ants can be controlled without difficulty.

For convenience ants may be divided into the following five groups :—

1, The Argentine ant; 2, house ants; 3, lawn ants; 4, mound or meat ants; 5, sugar ants.

1. The Argentine Ant (*Iridomyrmex humilis*)

In Victoria the Argentine ant is at present confined to certain Melbourne suburbs, but it is spreading slowly. It is a singularly troublesome pest entering houses in search of food, and causing constant damage and annoyance by its persistent activity.

Vigorous efforts should be made to stamp out this ant if once it appears. The individual ants are about one-eighth of an inch long and brown in colour. *They can be distinguished from other house ants of similar appearance by the absence of the familiar ant smell when they are crushed.*

Control.

Tests by the Department of Agriculture have demonstrated that correct use of the "Standard Government Formula Argentine Ant Bait" provides a simple and effective method of controlling the Argentine ant. The measure of control obtained will depend upon the care of the householder in applying it and in the continuity of its use.

Preparation of the Bait.

In the United States of America, where considerable research has been carried out on this pest, a poison syrup bait known as the "Standard Government Formula Argentine Ant Poison" has been perfected. This is prepared as follows :—

Sugar (granulated)	1 lb.
Tartaric acid (crystallized)	10·3 grains
Benzoate of soda	14·6 grains
Water	$\frac{5}{8}$th pint
Sodium arsenite (chemically pure)	26 grains
Honey	$2\frac{1}{3}$ oz.

Specific directions for preparing this syrup are as follows :—

Warm five-sixths of a pint of water in a clean vessel over a low fire. When it is tepid, add the tartaric acid, the benzoate of soda, and then the sugar slowly, and stir constantly to prevent burning. Measure the depth of the liquid in the vessel with a stick. Slowly bring the mixture to the boil and allow it to simmer for 30 to 40 minutes.

Remove from the stove and add water to the original depth on the measuring stick to make up for evaporation. Stir in the two and one-third ounces of honey before the mixture cools; then add the 26 grains of sodium arsenite which has been dissolved in 1·8 fluid oz. of hot water and partially cooled before pouring into the syrup.

By Government regulation all commercial manufacturers of this bait must be registered and the bait must comply with the following standard :—

Sodium arsenite	0·12–0·20 per cent.
Acidity (as tartaric acid)	0·00–0·10 per cent.
Solids	50·0°–56·0° Brix.

A suitable poison bait container.

Containers for the Bait.

Any type of watertight container will serve the purpose as a container for bait, but it must be clean and should be provided with a lid. Tins or waxed paper cups are the most satisfactory.

Provision for the entry of the ants is made by punching holes in the side or by indenting the top. The success of the treatment depends on the worker ants taking back the poison bait to the queen ant. For this reason, wood-wool, straw, or even twigs, should be placed at the bottom of the containers to prevent the ants drowning in the syrup.

Quantity of Bait to Use.

Not less than 1 pint of bait should be used for each treatment, and on heavily-infested properties up to 4 pints should be used. In a tin with a capacity of 6 fluid oz. ($3\frac{1}{2}$ in. x $2\frac{1}{2}$ in.) place 1 to $1\frac{1}{2}$ fluid oz. of bait, that is, a pint of bait should be divided between 15 and 20 containers.

The greater the number of baits used the more rapid will be the reduction in the ant population, but for any degree of control at least one pint should be used at each treatment.

Setting Out the Baits.

Place the baits at a distance of about ten feet all round the *outside* of the house, with a few extra outside the kitchen. This will prevent entry of the ants into the house, but to give control over the whole property, the baits should be placed along the inside of the fences and wherever the ants are seen.

Choose sheltered positions to retard the drying of the syrup, and remember that these baits are effective for only six to eight weeks in warm weather, and should be renewed after this period. The old syrup should be thoroughly cleaned out of the receptacle before fresh syrup is put in.

Sometimes the ants may be found nesting under particular tins, in which case the tin should be moved elsewhere and the nest treated with kerosene, creosote, or carbon bisulphide.

The bait is extremely poisonous and it is inadvisable to prepare it in the home. Supplies can be obtained commercially from registered manufacturers. The only manufacturer at present registered with the Department of Agriculture is the firm of Felton Grimwade and Duerdin Pty. Ltd., 342 Flinders-lane, Melbourne.

If a householder wishes to prepare the baits, care should be taken to adhere strictly to the formula. Slight variations may render the bait unattractive to the ants.

Warning.

As the bait is poisonous, bait tins should be placed where young children cannot interfere with them. It may be necessary to nail the tins to wooden supports out of reach of children.

Other Methods of Control.

Occasionally, it may be desired to use supplementary measures to reduce the ant population more rapidly. In such instances the nests can be destroyed by injecting into them carbon bisulphide, or any other soil insecticide, or by pouring kerosene or creosote over the nests.

DDT

For immediate relief, the runways of the ants, the parts of the house foundations over which they are moving, skirting boards, and edges of paths and other places where the ants are seen should be sprayed with a solution or emulsion containing 5 per cent. DDT. This will leave a residual film of DDT. If the ants persist the spray should be repeated.

Spray treatment will greatly reduce the numbers of the ants but baiting is advisable to destroy the nests where the insects breed.

Ants suspected of being Argentine ants should be forwarded to the Biologist, Plant Research Laboratories, Burnley, for identification.

PREVENT THE SPREAD OF THE ANTS.

The principal means by which the pest is spread is by the transfer of plants. Householders are asked to co-operate by making certain that no infested material of any sort is shifted into uninfested areas.

2. House Ants (*Various Species*)

House ants are usually about the size of the Argentine ant and may be brown or black. They are not as active or persistent as the Argentine ant, and may be temporarily controlled by the use of a DDT spray which will reduce their numbers. A 5 per cent. solution of emulsion of DDT should be applied to the house foundations where necessary, skirting boards, paths, and any other places frequented by the pests.

For permanent control the following bait is recommended :—

Honey	.. 8 oz.
Water	.. 1 oz.
Sodium arsenite ..	.. 12 grains.

To prepare the bait the sodium arsenite should be dissolved in the warm water which should then be mixed thoroughly with the honey. *The bait, which is poisonous, must be kept out of the hands of children or irresponsible persons.* Place it in small tins, each containing one fluid oz., with lids, and holes in the sides for the entry of the ants. The tins should be placed outdoors in locations frequented by the ants.

This bait is not effective against the minute ant *Monomorium pharaonsis* (Pharaoh's ant) which is sometimes troublesome in houses.

To control this ant a 5 per cent. DDT solution or emulsion should be carefully sprayed into all crevices from which ants are emerging, and over the skirting boards, cupboard legs, &c., which they must cross to reach food. Poison baits containing thallium sulphate have been recommended also to control this ant. The formula and method of preparation of an American bait are as follows :—

Dissolve 2 grams of thallous sulphate, Tl_2SO_4, carefully weighed, in ½ pint of lukewarm, not hot, water. In a separate container mix ½ pint of water, 1 lb. of granulated sugar, 3 oz. of strained honey, and 1½ fluid oz. of glycerin. Bring this mixture to the boil and remove from the fire. Cool for about five minutes, add the solution of thallium sulphate, and stir thoroughly. Label "Poison" and store in a cool place.

WARNING.

Thallium sulphate is a deadly poison. The bait should be placed in tins as described for the Argentine ant and care taken to ensure that children cannot interfere with the tins.

3. Lawn Ants (*Pheidole sp.*)

These small ants which are sometimes troublesome in lawns, where they throw up small heaps of earth, may be controlled by dusting with 5 per cent. DDT dust at a rate of half an oz. of dust per square yard of lawn.

4. Mound or Meat Ant (*Iridomyrmex detectus*)

The large mound or meat ant is usually found throwing up mounds in bare soil, and its presence in the vicinity of dwellings may cause annoyance.

This ant is best controlled by treating the nests with any commercial dust containing DDT or a mixture of DDT and benzene hexachloride. The dust should be applied at a rate of one oz. to every four holes. A little dust should be shaken down each hole and the rest spread around the mouths of the holes.

5. Sugar Ants (*Camponotus sp.*)

The nests of these large, slow-moving ants are frequently found near dwellings, where their habits of tunnelling under concrete paths and into masonry foundations render them objectionable. They may be controlled by treating the entrance holes to the nests with any commercial dust containing DDT, or DDT and benzene hexachloride, at a rate of half an oz. per entrance hole.

Some of the dust should be shaken down the hole and the remainder sprinkled around it. If complete control is not obtained by the first treatment it should be repeated.

When rapid control is required the nests should be treated with carbon bisulphide. Pour half an oz. down each entrance hole and cover with moist earth. Carbon bisulphide is very inflammable and must never be used near a naked flame.

THE VEGETABLE GARDEN

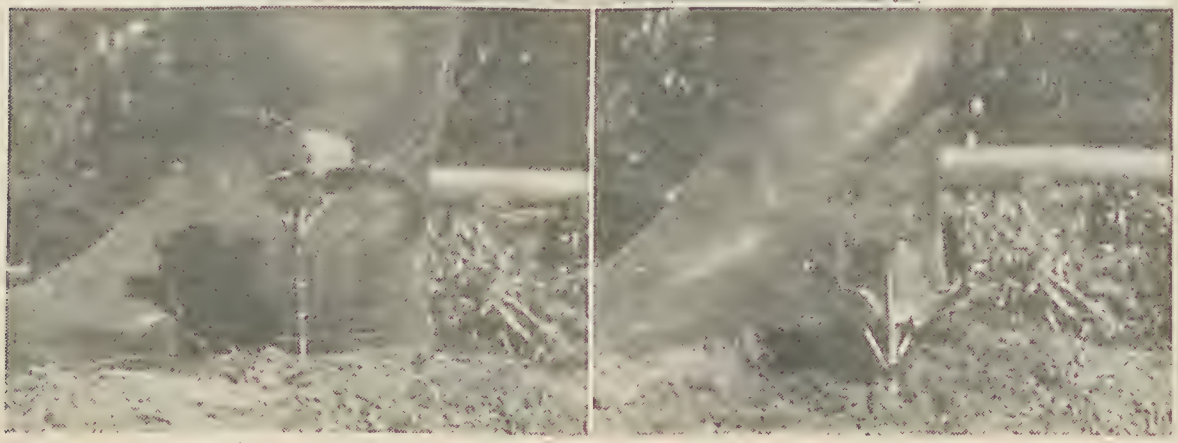
By GEORGE HYAM, Horticultural Supervisor.

PLANTING OUT LEAF VEGETABLES

FEBRUARY is one of the main times for planting winter and spring leaf-vegetables such as cabbages, cauliflower, and Brussels sprouts in all districts, including the hot northern areas. Planting often has to be done on hot days, and, for the first few weeks thereafter, the plants have to withstand hot and dry conditions. As a result, some extra care is needed when transplanting at this time. All these crucifers do best on soils having been prepared by digging in liberal quantities of organic manure in the form of rotted stable, farmyard manure or compost a week or two before planting. This should be turned under to a depth of at least 4 inches for this type of crop, so that the manure will not contact the roots of the newly-planted seedlings. Then, just prior to planting, mark out the row with a line and, alongside, draw out two furrows each side of the line, about 4 inches away from it, to a depth of about 4 inches. The furrows should be about 2 inches wide at the bottom. Along these spread 1 oz. per linear yard of 5 : 1 : 1 superphosphate, ammonia, and potash in a narrow band. Market gardeners' mixed fertiliser could be used instead, and this banding method is the best way to apply fowl manure that has not been previously rotted down with straw.

When fowl manure is used, it is advisable to add 1 oz. of superphosphate per yard of row. Fill in the manured furrows, and, if the soil is dry, apply water the day before planting. Unless large heads are required, and if the soil has been enriched as described, the spacing in small gardens can be as close as 24 inches between plants. If double rows are planted, stagger the plants in each row so that they are not opposite each other if this spacing is used. The seedlings should have been well hardened in the seed beds, and the day before lifting, the seed bed should be well soaked. Lift the plants with a fork with as much soil retained on the roots as possible.

In the garden, planting with a trowel is better than by dibber, so that the roots are not unduly restricted. Planting depth is important and the plants should be



Correct depth of planting is important. Top.—Too deep. Left.—Too shallow. Right.—Correct.

placed so that the lowest leaves are just at ground level. In summer, fill in the soil without ramming; then apply water to settle the soil. This will leave a small depression around the plants which can be retained until the plant is well established for watering purposes, particularly if the plants have to be watered with a can. In dry areas, a little temporary shade over each plant given by a piece of brushwood inserted alongside will make scorching less likely. Water daily for the first week or two, and then reduce the waterings to one good soaking per week, unless the weather is exceptionally hot, when more frequent waterings may be necessary. The plants should not be allowed to flag once they are established. Dusting or spraying against cabbage grubs and aphis should start as soon as the plants establish. If the growing tips of young plants are attacked, they will never heart properly.

CELERY IN THE HOME GARDEN

Although celery is one of the more difficult crops to grow to perfection, it can be recommended where the soil is friable and of a loose texture, and where water is available. February is a good month to plant out seedlings, and these can be used from the end of May and throughout the winter.

Modern so-called "self-blanching" varieties, such as Golden or White Plume, do not need the deep trenches formerly used, but, even for these, the plants are better placed along the bottom of a shallow trench. For a single row, a trench 15 inches wide should be dug; for a double row, increase this to 18 inches. Dig out the soil to a depth of 8 to 10 inches, and, along the bottom of this, fork in a 4-in. layer of rotted organic manure. Replace the top soil so as to leave a shallow trench about 3 or 4 inches below ground level. If seedlings are purchased, see that the foliage is quite free from spots or other markings and that the stems are stiff and upright. Box-grown seedlings with good bushy roots are preferred to seedlings lifted from seed beds. Plant the seedlings along the bottom of the trench, spacing them 6 inches apart in the row. If in double rows, space the rows 8 inches apart. This close planting assists the blanching of the stems later.

Celery is a gross feeder, and its quality largely depends upon liberal feeding during growth in addition to the heavy manuring prior to planting. Moisture is also important, and this is best applied by frequent flooding of the shallow trench in which the seedlings should be planted. Other causes of poor-quality celery are attack by leaf-spot, rust, or mildew. However, these are easily controlled by regular spraying or dusting with a fungicide like bordeaux or copper dusts. Care should be taken to obtain seedlings sown from seed that has been heat treated before sowing, as the abovementioned diseases can be seed borne, and affected seedlings rarely come to maturity.

Control measures should be applied at intervals of three or four weeks starting from when the plants first establish. Side dressings of 5 : 1 : 1 superphosphate, ammonia, and potash at the rate of 1 oz. per 6 feet of row should be applied every month, starting six weeks from planting. If celery is required for cooking purposes, only the plants can be put out on level beds with less manure but they should still be well watered to prevent them becoming too stringy. Methods of blanching salad celery will be given in a later issue.

OTHER FEBRUARY WORK

Early February is a good time to sow French beans in the hot inland districts. Summer crops of French beans often fail to set on account of the heat causing the flowers to drop. The increasing humidity of autumn generally results in a good set. In southern districts, it is best to sow butter beans rather than French beans at this time as they are less likely to catch an early frost.

Broad beans can be sown at the end of the month in all districts. Peas for the autumn can be sown now, using Wm. Massey or Melbourne Market in the north and Greenfeast in southern areas.

Tomatoes should be kept in crop by side dressings of sulphate of ammonia or liquid manure, together with plenty of water and the removal of any stems that have fruited, and also the encouragement of new lateral growth. Picking and using some of the early fruit of vine vegetables will help later cropping of fruits for storage.

(continued on page 95)

THE FLOWER GARDEN

By T. H. Kneen, B.Agr.Sc., Principal,
School of Horticulture and Primary Agriculture, Burnley Gardens.

SPRING-FLOWERING BULBS

THE period February to April is an important one for the planting of a wide range of spring flowering bulbous plants. Among these are Tulip and Hyacinth; Ranunculus and Anemone; various South African bulbs such as Freesia, Sparaxis, and Babiana; Grape Hyacinth; Lachenalia. During this period bearded irises can be divided, while in late autumn (May) the following can be divided and replanted—Agapanthus, Canna, Alstroemeria, Watsonia, lilies, and Lily-of-the-valley.

South African Bulbs

The South African group of bulbs includes such well-known plants as Watsonia, Freesia, Ixia, Sparaxis, Babiana, and Montbretia. These bulbs are very hardy, like a sunny position and are best left undisturbed for years. They increase freely and grow easily from seeds; are very good for naturalizing—some species have become weeds—and will stand a fair amount of dryness. They are all useful cut-flowers, and most of them are fragrant.

Tulips and Hyacinths

Many gardeners are anxious to grow tulips and hyacinths, but, having planted a few bulbs, have been disappointed with the results.

The truth is that both of these bulbs require a cool climate and a deep fertile soil that is well drained. Such conditions are to be found in the deep reddish soils of the Dandenong ranges east of Melbourne. In the Melbourne metropolitan area, however, the soils are generally too shallow and infertile to favour the growth of these bulbs. Of course, it is possible to make a bed that is sufficiently fertile and well drained, but, unless the climate is relatively cool, the chances are that the bulbs will become smaller each year and tulips particularly may die out.

In spite of this discouraging note, there is an urge in every gardener to grow something novel or something which interests him particularly, and, if tulips or hyacinths fall into that category, there is no reason why a small stock should not be purchased and planted in a suitable bed.

A supply of large sound bulbs can be expected to give good results in the first year, while even a small number grown in pots can give much pleasure.

Tulips are best grown in a formal bed, using only one or two varieties or in a bed with such spring flowers as forget-me-not and primrose. The advantage of such a bed is that, in less favorable areas, the bulbs may be lifted every year for planting in a new bed which has been well enriched with cow manure and mixed fertilizers, after trenching to a depth of 2 feet.

Remember, however, that deep trenching of a heavy soil is apt to form a pit which will hold water during winter and spring months. Some form of underground drainage from the lower sides of the bed and at the depth of trenching therefore should be provided. The roots will penetrate to a depth of 18 inches in deep soil, but will soon be killed if water is allowed to accumulate within the root zone.

Before planting, grade the bulbs into sizes and plant 4 to 5 inches deep according to bulb size, the larger bulbs being planted at the greater depth, and 6 inches apart.

There are a number of distinct types of tulips referred to in catalogues. The common garden tulips are supposed to originate from the one species native in Russia and Asia while early tulips originate from another species.

Parrot tulips are fringed forms of the common tulip, but the stem is not so stiff and the head is heavy.

The Darwin tulips are the tallest and strongest, late flowering, self coloured, and scentless.

The Rembrandt tulips are similar to Darwin tulips but bear variegated flowers.

Cottage tulips, usually mid-season flowering and scented, are distinguished by long-pointed petals and are more graceful than Darwins.

"Breeder" tulips are self-coloured, similar in form to Darwin, but with certain colour differences.

It is suggested that a selection of standard varieties of Darwin tulips be made as a basis of a collection. There is a wide range of colours available except in true blues. The normal flowering time of tulips is in September and October.

Hyacinths are the more accommodating as far as soils and climate are concerned, otherwise their cultural requirements are similar. There are two main types—the Early Roman types are very hardy and flower in July and August, while the flowers are small, white, or blue, and not so numerous as the more popular Exhibition type, which has large closely-packed flowers in a wide range of shades and is later flowering.

Ranunculus and Anemone

The Ranunculus and Anemone are spring-flowering plants with rather similar requirements. Seed may be sown in January and February for planting out in April. Corms held over from the previous season may be planted in April and May, with the claws downward, at a depth of 1 inch, and spaced 4 to 6 inches apart. After flowering it is a good plan to discard any inferior types and retain corms and seed from the better ones.

Corms give the best flowers in the second year and should be discarded after three years. It is quite usual to treat them as annuals raising them from seed each year.

Minerals for Stock

Common salt, which has a stimulating effect on appetite, should be a major constituent of all licks for horses, sheep, and cattle, but, in licks for pigs and poultry too much salt may be injurious.

Calcium phosphate is valuable as a bone-builder, and is needed by growing stock, breeding and milking animals. The best method of supplying this mineral to stock is to top-dress the pastures with superphosphate. Meatmeal contains much calcium phosphate, and if fed as a protein supplement no further calcium is necessary. There is a deficiency of lime (calcium) in most concentrates and grain, and this can be made good by feeding 3 lb. of the mixture—4 parts lime to 1 part salt—to each 100 lb. of grain for horses, cattle, sheep, and pigs. For poultry, the lime is obtained from the shell-grit. In addition add ½ to 1 lb. of salt to each 100 lb. of mash.

Iron deficiency in animals is rare, except in milk-fed animals such as sucking pigs. Sufferers may be cured by running them on pasture or placing a sod of fresh earth in the pens daily.

—[Contributed by the Live Stock Division.]

The Vegetable Garden—*(continued from page 93)*

Cucumbers and melons should be picked regularly as leaving over-matured fruits on these vines quickly stops further growth. If mildew appears on these cucurbits after summer rains, spray with bordeaux or a copper-oxychloride preparation. Lime-sulphur can also be used except on melons.

Late onions should be lifted, dried off, and stored in thin layers in an airy shed or tied in bunches and hung up. Use thick-necked or broken-skinned bulbs first as these will not store long. Storing onions on wire-netting racks, heads downwards, is a particularly good method.

Accredited Brucellosis-free Herds (Swine)

The following herds of pigs have been accredited as free of swine brucellosis (contagious abortion of pigs) by the Department of Agriculture.

An accredited brucellosis-free herd of pigs is one in which all animals therein have been subjected to two successive blood tests for brucellosis with negative results at intervals prescribed by the Chief Veterinary Inspector of the Department.

In order to remain accredited, a semi-final or annual re-test (as determined by the Chief Veterinary Inspector) of all animals in the herd shall be conducted. If, at a re-test, any animal fails to give a negative reaction to the test, the herd shall not be declared brucellosis-free again until two tests of the complete herd have been carried out with negative results.

Full particulars of the Accredited Swine Brucellosis-free Herd Scheme and application forms may be obtained from the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

Name.	Address.
Anderson, W. H. and C. H.	"Merrileugh," Inverloch
Baker, J. J.	Bannockburn
Barclay, F.	Tyabb
Barclay, T. H.	Tyabb
Barker, L. F.	Killingsworth
Bell, John T.	Yarra Glen
Betts, V. R.	Craig's Lane, Pomborneit
Bidgood Bros.	Wodonga
Bodey, A. A.	"Bonnyview," Dooen
Bright, George H.	Dumbalk
Bruce, J. E.	"Bimbimbie," Dewhurst
Buller, R. A.	Beaconsfield
Butler, J. H.	Newstead
Cardwell, S. R.	Eskdale
Cash, I. M., and Sons	Jindivick
Castle, L. H.	Clarinda
Chapple, S. T.	Rye
Chard, F. J.	Private Bag, Terang
Chisholm, R. J.	Archie's Creek
Churchill, S. R.	Narre Warren, North
Churchill, Stanley	Woolamai
Coates, R. J. H.	Corangamite
Cockbill, Wm.	Rockbank
Coleman, F. and G.	Toongabbie
Cornell, J.	Wheeler's Hill
Coster, John	Newry
Coulthard, J. J.	"Walamba," Whittlesea
Cox, H. H.	Jacaranda Stud, Leopold
Craig, A. A.	Yeoburn East, via Kerang
Critten, H. S.	Dumbalk
Devine, Herbert	Swan Marsh
Dingwall, A. E.	Maffra
Dookie Agricultural College	Dookie
Doornbusch, J. L.	"Starpark," Nhill
Dougall, J. K.	Hastings
Dowie, Alexander	Mt. Moriac
Doyle, Dr. G.	Arthur's Creek
Duncan, C. B.	Cranbourne
Dunstan, John	Tomahawk Creek
Ellwood, A. H.	Paschendale
English, G. H.	Tongala
Fairchild and Clutterbuck	Tinamba
Foletta, G. G., and Son	"Acheron Park," Buxton
Fraser, A. D. J.	Bamawm
Garry, Thos. E.	Kernot
Gay, Leonard M.	Gormandale
Goding Bros.	Moorooduc
Gravener, S., and Sons	Clayton
Greig, J. F. and I. S.	Gnotuk
Hamblin, A. T., and Sons	Toolleen
Harris, Clement C.	"Egerton Villa," Loch
Harris, J. D.	Malden Valley
Harrison, C. T.	"Eastside," Pomborneit
Hawtin, I. E. and F.	"Rossmoyne," Colac
Haywood, Dr. A. R.	Hastings
Haywood, G. T. B.	Cranbourne
Hodgins, A. S.	Tyabb
Howard, Alex	Glenfyne
Jackson, Wm. C.	"Patterdale" Stud, Main Ridge
James, W. E.	Templestowe
Jephson, W. T.	Stacey's Bridge
Kergerm, A. C.	Marshall
Kilby, E. A.	Narre Warren North
Lacey, S. T.	Main Ridge
Longerenong College	Dooen
Mackenzie, A. S.	Upper Beaconsfield
Marriott, F. C.	Bentleigh East
Marshman, A. D.	Archie's Creek
Miller, A. J.	"Glenvale," Whittlesea
Mills, Robert	Naring East
Moore, Newton J.	Kawarren, via Colac
Mundy Bros.	Orbost
McInerney, M. J.	Nyarrin
Myers, F. P.	Bittern
McMillan, Walter N.	Mooroopna North
Nagle, E. V.	Bacchus Marsh
Noble, T. M., and Sons	Maffra
Northcote Children's Farm	Bacchus Marsh
Northey and Co.	Koorilla Park, via Bethanga
Osborne, L. R.	Strathfieldsaye, via Bendigo
Peters, W. H.	Heatherton
Petersen, E. V.	Korumburra
Richards, Albert H.	Dumbalk, via Meeniyan
Rintoul, J. T. C.	Glengarry
Roy, W. A.	Morrell's Hill, via Boolarra
Russell, J. A. and A. D.	Hendersyde, via Tatura
Sexton, John	Swan Marsh
Simspon, Ronald D.	Birregurra
State Experiment Farm	Rutherglen
Taylor, B. Hogan	Wandeen Farm, Harkaway
Trenery and Soderland	"Promview," Foster
Trigg, A. J.	Bungaree
Trigg, N. H.	Bullarook
Warry, A. and Sons	Delburn
Whelpton, B.	Whittlesea North
Whytcross, D. J. (Jnr.)	Swan Marsh
White, G. W.	Boolarra South
Williams, A. W. and S.	"Hillview," Weerite
Williams, Geo. A.	Paternoster-road, Emerald

Bacon Pig Competition

This year's Bacon Pig Competition will be held during the first week in May, and conditions will be similar to those governing last year's contest. Entries will be free, and open to all pig breeders in Victoria, and entry forms may be obtained from the Offices of the Australian Meat Board, 401 Collins-street, Melbourne, C.1.

By A. MORGAN, B.Agr.Sc., Senior Irrigation Officer.

HISTORICAL

NO one foresaw that, from a small beginning at the State Research Farm, Werribee, in 1914, the area under irrigated pastures in Victoria by 1946–47 would be 326,822 acres, and no one anticipated that an insignificant annual clover which was regarded as a weed (that is, subterranean clover) would, eventually, prove to be one of the most valuable legumes in the temperate regions of Australia.

As the years went on, the value of the area sown to pasture at the Research Farm was demonstrated by its ability to carry stock, the health of the stock, and the longevity of the pasture as compared with lucerne.

Lucerne had been the subject of much experimental work at the Farm, particularly along the lines of :—

(*a*) Suitable varieties.
(*b*) Manurial treatment.
(*c*) Watering treatment.
(*d*) Harvesting methods.
(*e*) Layout of land.

It was logical to apply the relevant results of these tests to the growing of pastures. Thus the border-check system of layout, the frequency of watering, and top-dressing with superphosphate were a legacy from lucerne experimental work and were applied to pastures in an empirical fashion, and later were confirmed by further experiment.

It might be stated at this stage that the observations on the original "shot-gun" mixture sown indicated that the mixture could be greatly simplified and the rates of seeding considerably reduced. Various grasses were eliminated for various reasons, which may be briefly summarized as follows :—

Fescues were subject to ergot; prairie grass and timothy grass did not stand up to grazing as well as perennial rye grass and cocksfoot.

Kentucky blue grass survived, but there was some disinclination to plant grasses of this type with underground creeping stems (rhizomes). This was because of difficulty in eradicating them when, and if, desired. Red clover (cowgrass) and alsike clover were retained because of their vigour in the early years of the pasture. In these tests the four most valuable species proved to be perennial rye grass, cocksfoot, white clover, and strawberry clover.

Intensively grazed pasture at Werribee. This pasture, which is growing on heavy clay loam, is 32 years old. Perennial rye grass, Kentucky blue, cocksfoot, white clover, and strawberry clover comprise the sward.

It must be noted that reliable strains of Phalaris tuberosa were not obtainable under any seed certification scheme in those days, and farmers were busy in many places digging out Paspalum, which was regarded as a weed and a nuisance in lucerne.

The experimental work at the State Research Farm, therefore, was carried out on permanent pasture in which the above four species—perennial rye grass, cocksfoot, white clover, and strawberry clover—were predominant. When it was decided to establish demonstration plots in the northern irrigation districts, the plan was to sow one half of the plot with the standard mixture, and to sow a checkerboard design including those and the other discarded species as a check on the Werribee experience.

Research with pastures proved to be far more complicated than with lucerne. Production (yield) of green stuff and of dry matter, the primary consideration, proved to be more difficult to ascertain.

MEASUREMENT OF PRODUCTION

The first trials along these lines were attempted by meadow hay cuts in the spring. It had been observed that top-dressing with superphosphate greatly stimulated the growth of pastures, but the hay cuts from plots manured with different amounts of superphosphate did not demonstrate this, and so what had appeared to be the most convenient method of measuring production from pastures was discarded as comparatively useless.

In 1926, Mr. J. E. Thomas, B.V.Sc., B.Agr. Sci., while engaged in sheep-feeding trials at Werribee, obtained very high yields of pasture clippings from small areas, but the results were not published immediately because of the lack of precedent for such yields. The first published work on the subject appeared in England, and it provided the technique and precedent for work in Australia.

The English investigators used a motor lawnmower to harvest the pasture at regular and frequent intervals which approximated to artificial grazing. Although the limitations of this method were obvious (for example there was no return of valuable minerals to the pasture in the animal excrement) it proved a very valuable method, and the knowledge of pasture productivity and nutritive value gained by its use gave a tremendous stimulus to pasture research.

Work along the lines of the English investigations commenced at Werribee in 1929. The first objectives were to determine the effects on productivity of permanent pasture of (*a*) varying rates and frequencies of watering; (*b*) varying manurial treatment.

WATERING TRIALS

Dealing first with the watering trials, a full report of which was published in the Journal of the Department of Agriculture, April, 1932, it is as well to offer some description of the conditions of the experiment, as it has been clear throughout that the pasture type, soil type, and other factors affect the results in one way or another.

The soil was at that time described as clay loam of alluvial origin, which, under ordinary irrigation methods, took no more than 3 inches of water at an irrigation.

Later, in 1940, it was examined in detail by Mr. F. Penman, M.Sc., Deputy Chief Chemist of the Department of Agriculture, in connexion with an investigation of the effects of irrigation on soil structure, &c., and was described as a brown loam to 7 inches, then red-brown medium to heavy clay to 12 inches. From 12 to 16 inches yellow-brown clay loam of platey structure, changing to brown, fine, sandy loam persisting to 45 inches.

The type of profile, stated Mr. Penman, "appears to be due to the burial of an earlier alluvium by a further deposition of different character," and he demonstrated a "close link between this Werribee soil and others which have been described in the Goulburn Valley and Rochester districts".

Lucerne had been grown on the area up to 1924, and a heavy dressing of lime at one time had resulted in an alkaline reaction to a depth of 9 inches. To conduct experiments with a soil type which, under ordinary irrigation practice, absorbs 3 inches of water at each watering, and to obtain higher absorption (to 6 inches) at any one watering, two methods suggest themselves :—

(*a*) To pond the water in the area until the requisite absorption is secured.

(*b*) To adopt the "supplementary" watering principle, by which the additional water is absorbed in a series of consecutive daily irrigations.

SUPPLEMENTARY METHOD ADOPTED

The latter method was adopted as it avoided damage due to scalding in hot weather. The manurial treatment of the area was uniform (2 cwt. superphosphate per acre), and the 2½-acre paddock was cut by motor mower in such a way as to secure comparable results from each treatment. Within the limits of the lay-out (i.e., one bay to each watering treatment), the harvesting was done in such a manner as to allow of some statistical treatment of the results.

The pasture complex is a very delicately balanced one, and any change in management, whether in regard to watering, manuring, grazing, &c., is likely to be shown up by an alteration in the relative aggressiveness of the various species included in the mixture. Thus, while the experiment started with a uniform pasture mixture the different watering treatments soon produced a variety of pasture types in which one or more species was favoured, or retarded, by the particular watering treatment given.

It is, therefore, incorrect, strictly speaking, to say that such and such a pasture mixture gives a certain result under one watering treatment, and another certain result under another watering treatment. It is more correct to say that a certain watering treatment produces, from a certain mixture sown, a certain type of pasture which has certain yield characteristics, other things being equal.

To deal with the various aspects of the experiment, regular botanical surveys and samplings for fodder analysis were carried on in conjunction with the weighings of the harvested material.

INFLUENCE OF IRRIGATION METHODS ON PRODUCTION

The various watering methods produced, from what was originally a uniform sowing, distinct pasture types. These are easiest described by listing the proportions of white clover and of subterranean clover, as

Irrigated pasture at Werribee, showing rye grass, prairie grass, and white clover.

Meadow-hay plots.

determined by the botanical surveys made before each harvest with the motor lawn-mower.

Thus, for an annual usage of 18 inches of water, the white clover content was 38 per cent. with six waterings of 3 inches, as compared with 24 per cent. with three waterings of 6 inches. Subterranean clover was 14 per cent. as compared with 33 per cent. The dominance of white clover was thus shown to be determined by the frequency of the watering, and similarly the efficiency of the water used was shown to be slightly greater (1·18 inches per 100 lb. of greenstuff, as compared with 1·20 inches in the case of the "six of 3 inches").

When the annual usage was raised to 24 inches, applied either as six waterings of 4 inches, four waterings of 6 inches, or eight waterings of 3 inches, more marked differences were observed. The white clover percentage rose to 60 and 62 respectively on the "six of 4 inches" and the "eight of 3 inches", but the alteration on the "four of 6 inches" was slight (a rise of only 3 per cent. to 27 per cent.). Subterranean clover remained almost the same on the "four of 6 inches", but was reduced to 11 per cent. on the "six of 4 inches".

Yield variations were comparable—efficiency of water used rose as follows:—Six of 4 inches, 1·16, as compared with four of 6 inches, 1·29. These efficiency figures include rainfall as well as irrigation water.

Increasing the annual water usage to 30 inches, six waterings of 5 inches gave no further increase in white clover; in fact, there was a slight increase in subterranean clover, which, however, a study of the errors of sampling, in connexion with the botanical analyses, showed was not statistically significant. The five waterings of 6 inches showed a significant decrease in subterranean clover (19 per cent.), as compared with the four of 6 inches and three of 6 inches (31–33 per cent.). This particular plot, however, showed the poorest efficiency of water in the whole experiment (1·42 inches per 100 lb. herbage), while the six of 4 inches showed the highest efficiency (1·16 inches per 100 lb. herbage). To date, only the 1930–31 season results have been quoted, and, at this stage, it might be mentioned that the same comparative results were obtained in 1929–30 season (viz., 1·85 compared with 1·28).

Another way the results were examined was by working out the ratio of white clover to subterranean clover in each plot. These are summarized and grouped for comparison as follows:—

White Clover, Subterranean Clover Ratio.

Waterings.	Ratio.
6 of 3 inches	2·7
3 of 6 inches	0·8
6 of 4 inches	5·6
4 of 6 inches	0·9
8 of 3 inches	5·7
6 of 5 inches	3·4
5 of 6 inches	2·4

The superiority of the six of 4 inches and the eight of 3 inches is seen immediately. Actually the highest ratio was obtained with a water usage of 36 inches, applied as six waterings of 6 inches, but, in the two seasons, this treatment gave

statistically significant lower yields of herbage than the six waterings of 4 inches.

It was not intended that the results of this experiment should be applied in practice, except insofar as the experiment had demonstrated the underlying principles of irrigation for best results with permanent pasture. The main principle demonstrated by the experiment was that "frequent waterings of moderate amount" was better practice than either "few heavy waterings" or "frequent light waterings".

Soil type comes into the picture, and variations to suit the various soil types are necessary. Another factor in some areas is the problem of "salt" and water-tables, which will be discussed later. Fodder value has to be considered, and also the modifying effect of variations in manurial treatment.

INFLUENCE OF MANURES ON PRODUCTION

So far no mention has been made regarding the effect of variation in manurial treatment, or in regard to the differences one might expect under grazing conditions as compared with experiments conducted with the motor lawn mower technique. However, it simplifies the discussion if the results from the lawn mower method are first examined and the principles established from those results are subjected to test under grazing conditions.

With manures, the factors investigated were :—

(1) Kind of manure.
(2) Optimum quantity to apply.
(3) Best time of application.
(4) Effects on botanical and chemical composition of the pasture.
(5) Effects of variation of both the irrigation method and the manurial treatment.

The answers to these questions were not obtained from a single test. Several distinct long-term experiments were carried out, but it would be tedious to describe each experiment in detail. However, the scope of the work is indicated by the following list :—

Potash manurial test.
Nitrogen manurial test.
Manurial trials (Latin squares).
Manurial trials with super-imposed watering tests.
Trials—time of application of superphosphate.

The trials of various manures under "water as required" system—i.e., irrigations given on the same basis as a grazing paddock, commenced in 1929 and were carried on for two seasons in one field and a further two seasons in an adjoining field. Full details were published in the Journal of Agriculture for February, 1933, and summaries have been issued by the Department.

Irrigated pasture plots at the State Research Farm, prepared for mowing.

Yields of Grass Hay and Sheep-grazing Data from Pasture Plots Sown September, 1925.

A.—N.W. Section, 1927–28 and 1928–29
B.—S.W. Section, 1931–32
} Field 2 S.W.

Plot (Rate of Manuring per Acre).	(A.) Lb. per 0·1 Acre (15 per cent. Moisture).		(B.)
	1927–28 (Cut 22nd November, 1927).	1928–29 (Cut 6th November, 1928).	Dry Matter 1931–32 (Cut 26th November, 1931).
No manure	338·5	220·0	271·6
Superphosphate, 1 cwt.	340·6	303·6	344·5
Superphosphate, 2 cwt.	360·7	333·6	382·6
Superphosphate, 3 cwt.	382·6	332·8	395·2
Superphosphate, 4 cwt.	395·9	348·5	410·5
No manure	358·1	309·4	334·1
Basic slag, 2 cwt.	354·0	385·0	456·0
Rock phosphate, 2 cwt.	323·8	325·1	423·6
Nitrate soda, 1 cwt.	313·9	353·6	417·9
Ammonium sulphate, 1 cwt.	296·7	339·2	447·5
Superphosphate, 2 cwt., plus nitrate soda, 1 cwt.	318·7	404·5	568·1
Superphosphate, 2 cwt., plus ammonium sulphate, 1 cwt.	320·6	402·6	518·0
No manure	292·6	376·3	410·3
Potassium sulphate, 1 cwt.	296·9	367·1	424·7
Superphosphate, 2 cwt., plus potassium sulphate, 1 cwt.	326·5	435·0	526·1
Superphosphate, 2 cwt., plus potassium sulphate, 1 cwt., plus ammonium sulphate, 1 cwt.	298·0	442·9	483·4
Superphosphate, 2 cwt., plus lime, 30 cwt.	278·0	422·8	458·5
Superphosphate, 2 cwt., plus gypsum, 30 cwt.	355·4	416·1	479·8
No manure	358·0	376·2	359·1

Sheep-grazing Data.

Season.	Sheep Grazing.	Sheep per Acre.
	Days.	Per Annum.
1927–28	5,978	6·55
1928–29	5,964	6·53

Manuring is so essential in irrigation farming that no apology is made for presenting the accompanying tables of results. A start is made with the hay cut figures to which reference was made earlier.

To illustrate the unsatisfactory nature of trials which rely exclusively on meadow-hay cuts, the following comparisons are presented :—

In S.W. section, season 1931–32, the increase in hay weight due to application of

Weighing the produce from irrigated pasture plots.

Pasture experimental field where mowing and grazing tests have been conducted.

YIELDS OF DRY MATTER (LB. PER $\frac{3}{5}$ ACRE) EXPRESSED AS PERCENTAGE INCREASES OVER "NO MANURE", S.W. SECTION, FIELD 2 S.W.

Plot.	Season 1929–30.	Season 1930–31.
	%	%
Superphosphate, 1 cwt./ac.	49·3	73·3
Superphosphate, 2 cwt./ac.	75·4	127·9
Superphosphate, 3 cwt./ac.	100·1	162·5
Superphosphate, 4 cwt./ac.	110·7	177·0
Basic slag, 2 cwt./ac.	54·1	84·7
Rock phosphate, 2 cwt./ac.	18·6	37·5
Nitrate of soda, 1 cwt./ac.	−0·5	4·0
Ammonium sulphate, 1 cwt./ac.	1·4	6·8
Superphosphate, 2 cwt., plus nitrate soda, 1 cwt./ac.	37·4	97·5
Superphosphate, 2 cwt., plus ammonium sulphate, 1 cwt./ac.	28·7	90·8
Potassium sulphate, 1 cwt./ac.	−5·1	2·4
Superphosphate, 2 cwt., plus potassium sulphate, 1 cwt./ac.	39·7	108·9
Superphosphate, 2 cwt., plus potassium sulphate, 1 cwt., plus ammonium sulphate, 1 cwt.	23·6	87·8
Superphosphate, 2 cwt., plus lime, 30 cwt./ac.	41·2	115·8
Superphosphate, 2 cwt., plus gypsum, 30 cwt./ac.	43·7	107·3
Difference necessary for statistical significance	10·2	10·7
Number of irrigations	12	11
Total water applied	Inches. 28·07	Inches. 23·53

1 cwt. superphosphate per acre was approximately 60 lb., i.e., an increase (over "no manure") of 22 per cent. In the same field, season 1930–31, when the motor lawn mower clippings were harvested every few weeks, the increase was 73 per cent. The above table shows the percentage increases, due to the various manuring treatments, for seasons 1929–30 and 1930–31.

The superiority of superphosphate in every case is easily seen because—

(*a*) all plots receiving phosphatic manure, alone or in combination, showed an increase over "no manure";

(*b*) all plots not receiving phosphatic manure showed no significant increase over "no manure".

The arrangement of the results shown below may facilitate comparisons. This is taken from February, 1933, *Journal of Agriculture* (Bartels, Beruldsen, and Morgan).

Two points are emphasized in the table.

(*a*) That the limit of top-dressing does not appear to have been reached with superphosphate 4 cwt./acre.

(*b*) That some manurial combinations (e.g., superphosphate plus potassium sulphate plus ammonium sulphate) may produce unexpected results which can only be determined by experiment.

A significant feature of the experiment was the lack of "staying power" shown by the "no manure" plots. In 1930–31, as compared with 1929–30, the "no manure" plot yields averaged 150 lb. less dry matter, i.e., 65 per cent. decrease. In comparison, the superphosphate 4-cwt. plot maintained its yield. The decrease in yield on the superphosphate 3, 2, and 1 was least in the order given.

Based on a large number of chemical analyses, it may be taken that the average phosphoric acid (P2 05) content of the non-manured herbage is 0.60 per cent. (dry basis), and it was calculated that the clippings taken from a "no manure" plot contained phosphoric acid equivalent to that in 1¼ cwt. superphosphate per acre.

It does not appear necessary to further labour the point in regard to the importance of top-dressing irrigated pastures, of the rye grass-white clover mixture, with superphosphate. The stress can be laid, however, on the fact that the dressings usually applied are not adequate, and that there should be a strong trend towards annual dressings of at least two bags for every acre of summer-watered pasture.

The sceptic may say, "But my pastures are paspalum and strawberry clover. They do not require such expensive manurial treatment." By observation, throughout all the northern irrigation districts however, this has been proved to be fallacious reasoning.

By regular and liberal manuring allied with careful irrigation, paspalum and clover pasture, if of good irrigation layout, can be transformed into a first-class rye grass and clover pasture.

Thus, in 1940, at Tragowel, the writer sowed paspalum dilatatum alone, and, at the present time, this plot, which has received a bag of superphosphate per acre annually, has a high content of perennial rye grass and white clover. Many irrigators at Cohuna, Rochester, and other northern-district centres, can quote similar experiences.

NATURE OF DIFFERENCES BETWEEN YIELDS OF DRY MATTER FROM VARIOUS MANURIAL TREATMENTS.

Plot Comparisons Made.	Nature of Difference.	
	1929–30.	1930–31.
Compared with "No Manure"—		
All plots receiving phosphatic manure	Increase	Increase
All plots not receiving phosphatic manure	None	None
Compared with superphosphate, 1 cwt./ac.—		
Basic slag, 2 cwt.	Increase	Increase
Rock phosphate, 2 cwt./ac.	Decrease	Decrease
Compared with superphosphate, 2 cwt./ac.—		
Basic slag, 2 cwt./ac.	Decrease	Decrease
All plots receiving a combination of superphosphate, 2 cwt., plus one or more other manures	Decrease	Decrease
Miscellaneous Comparisons—		
Superphosphate, 2 cwt./ac., compared with superphosphate, 1 cwt./ac.	Increase	Increase
Superphosphate, 3 cwt./ac., compared with superphosphate, 2 cwt./ac.	Increase	Increase
Superphosphate, 4 cwt./ac., compared with superphosphate, 3 cwt./ac.	Increase	Increase
Superphosphate, 2 cwt., plus potassium sulphate, plus ammonium sulphate with superphosphate, 2 cwt., plus ammonium sulphate	None	None
Superphosphate, 2 cwt., plus potassium sulphate, 1 cwt., compared with superphosphate, 2 cwt., plus ammonium sulphate	Increase	Increase
Superphosphate, 2 cwt., plus potassium sulphate, plus ammonium sulphate, compared with potassium sulphate	Decrease	Decrease

Further, the pasture containing rye grass is superior to the original paspalum pasture in its winter production, a characteristic in which paspalum is notoriously weak. Rhodes grass is even slower in recovering from winter dormancy and frost damage.

This reference to winter production of pastures brings up the subject of "distribution of production", as distinct from total annual production. However, before leaving "total production", the following results from pasture plots conducted by the Department of Agriculture in various irrigation districts should be of interest:—

YIELDS FROM PASTURE PLOTS—SWAN HILL AND COHUNA—ON GREY AND BROWN HEAVY SOILS.

(Average of seasons 1938–39 and 1939–40.)

Manurial Treatment (Cwt. per Acre per Annum).	Increase over "No Manure" † (Cwt. Dry Matter per acre).	
	Swan Hill.	Cohuna.
	cwt.	cwt.
Superphosphate 1	3·2	3·5
Superphosphate 2	9·1	12·5
Superphosphate 3	22·8	No plot
Superphosphate 4	25·6	27·6
Superphosphate 6	26·0	No plot
Superphosphate 2, plus ammonium sulphate 1	8·7	No plot
Superphosphate 2, plus potassium sulphate 1	13·0	9·4
Superphosphate 2, plus potassium sulphate 1, plus ammonium sulphate 1	9·2	No plot
Superphosphate 2, plus lime, 10 cwt.	24·4	9·7*
Superphosphate 2, plus gypsum, 10 cwt.	10·7	11·1*
Superphosphate 2, plus ammonium sulphate 1, plus lime, 10 cwt.	14·2	No plot

* 1 ton lime (or gypsum) every 5 years.

† No manure—Swan Hill, 54·1 cwt.; Cohuna, 77·4 cwt.

From Journal of Department of Agriculture, Victoria, 1941, p.p. 535-536 (G. B. Rayner).

Apart from the value of superphosphate as shown for both districts, the increased yield due to lime at Swan Hill, and the superiority of lime over gypsum, is of some interest, and will be dealt with more fully later.

MANURIAL TRIALS ON IRRIGATED PASTURE, TONGALA AND STANHOPE.

(Red-brown earths.)

Manurial Treatment (Cwt. per Acre per Annum).	Increase over "No Manure" (Dry Matter per Acre).	
	Tongala (Average 1938–39 and 1939–40).	Stanhope, 1939–40.
	cwt.	cwt.
Superphosphate 1	4·1	6·2
Superphosphate 2	10·4	6·6
Superphosphate 3	..	23·9
Superphosphate 4	23·9	22·0
Superphosphate 4 (in two applications)	24·7	..
Superphosphate 6	..	26·6
Superphosphate 2, plus ammonium sulphate 1	..	12·7
Superphosphate 2, plus potassium sulphate 1	10·9	12·2
Superphosphate 2, plus ammonium sulphate 1, plus potassium sulphate 1	..	10·2
Superphosphate 2, plus lime, 10 cwt.	..	8·4
Superphosphate 2, plus lime (1 ton each 5 years)	13·4	..
Superphosphate 2, plus gypsum 10 cwt.	..	14·8
Superphosphate 2, plus gypsum (1 ton each 5 years) ..	17·7	..
Superphosphate 2, plus ammonia sulphide 1, plus lime 10 cwt.	..	5·9
Bone fertilizer 2	10·9	..

MANURIAL TRIALS ON IRRIGATED PASTURE, TINAMBA (GIPPSLAND).

Treatment (Cwt. per Acre per Annum).	Lb. Dry Matter per Plot (Mean of Duplicate Plots).	
	A.	B.
1. No manure	35·0	33·0
2. Superphosphate 1	40·7	40·4
3. Superphosphate 2	48·9	41·2
4. Superphosphate 3	43·6	39·5
5. Superphosphate 4	45·6	41·5
6. Superphosphate 6	51·3	48·9
7. Superphosphate 2, plus lime 10	45·1	37·5
8. Superphosphate 2, plus gypsum 10	41·7	38·7
9. Superphosphate 2, plus sulphate of potash 1 cwt. ..	46·3	39·0
10. Superphosphate 2, plus sulphate of ammonia 1 cwt...	40·9	39·0
11. Superphosphate 2, plus ammonium sulphate 1, plus potassium sulphate 1 ..	45·3	42·7
12. Superphosphate 2, plus ammonia sulphate 1, plus lime 10	44·9	38·0

From the Journal of the Department of Agriculture, 1941, page 317 (G. B. Rayner).

The second instalment of this article will appear in a subsequent issue of the Journal.

CLASSES FOR WHEAT

MELBOURNE ROYAL SHOW, 1949

The Royal Agricultural Society has announced that there will be eight separate classes for wheat exhibits in the Melbourne Royal Show to be held from 22nd September to 1st October, 1949.

Classes include a special section for novice competitors, and for wheatgrowers in particular districts such as the Mallee and the Wimmera. One of the most popular classes last season was the "Sunshine" competition for one bushel of wheat grown in any district of Victoria, the variety to be one of the ten commercially-grown wheats as listed. Prize money amounting to £100 has been made available for the exhibits.

It is suggested that intending competitors should set aside some of their wheat before all of the seed for the coming crop has been pickled or sown.

The classes are as follows:—

Novice Class

Baldmin, Bencubbin, Diadem, Ghurka, Insignia, Magnet, Pindar, Pinnacle, Quadrat, Ranee 4H or Regalia (one bushel), grown in Victoria. Open to competitors who have not won a first prize for wheat at any previous Melbourne Royal Show. Prizes: £5, £3, £2, £1.

Mallee District Class

Bencubbin, Diadem, Ghurka, Insignia, Pindar, Quadrat, Ranee 4H or Regalia (one bushel), grown in the Counties of Millewa, Weeah, Karkarook, or Tatchera. Prizes: £5, £3, £1.

Wimmera District Class

Baldmin, Bencubbin, Diadem, Ghurka, Insignia, Magnet, Pindar, Pinnacle, Quadrat or Ranee 4H (one bushel), grown in the Counties of Lowan, Borung, or Kara Kara. Prizes: £5, £3, £1.

Other Districts Class

Baldmin, Bencubbin, Diadem, Ghurka, Insignia, Magnet, Pindar, Pinnacle, Quadrat, Ranee 4H or Regalia (one bushel), grown in any district of Victoria other than those already specified. Prizes: £5, £3, £1.

"Sunshine" Wheat Competition—All Victorian Districts

Baldmin, Bencubbin, Diadem, Ghurka, Insignia, Magnet, Pindar, Pinnacle, Quadrat, Ranee 4H or Regalia (one bushel), grown in any district of Victoria. To be judged on bushel weight; general appearance; milling and baking quality as determined by chemical and physical tests. First prize £10 cash and trophy valued at £5; second £6; third £4; fourth £2.

The following classes are open to exhibits grown in any district or State:—

Wheat (one bushel), any variety

Prizes: £5, £3, £1.

Collection of Three Varieties of Wheat—Medium Strong

Baldmin, Celebration, Charter, Diadem, Dundee, Eureka, Florence, Ford, Gabo, Gular, Hard Federation, Javelin, Koala, Kendee, Minister, Rapier, Scimitar, Sword, Wardfir, Warigo or Yelta (one bushel of each). Prizes: £7, £4, £2.

Collection of Wheat (Three Varieties) other than Strong or Medium Strong (one bushel of each)

Prizes: £7, £4, £2.

Entry forms and further particulars concerning the above wheat classes may be obtained from the Secretary, Royal Agricultural Society, 422 Collins-street, Melbourne, C.1.

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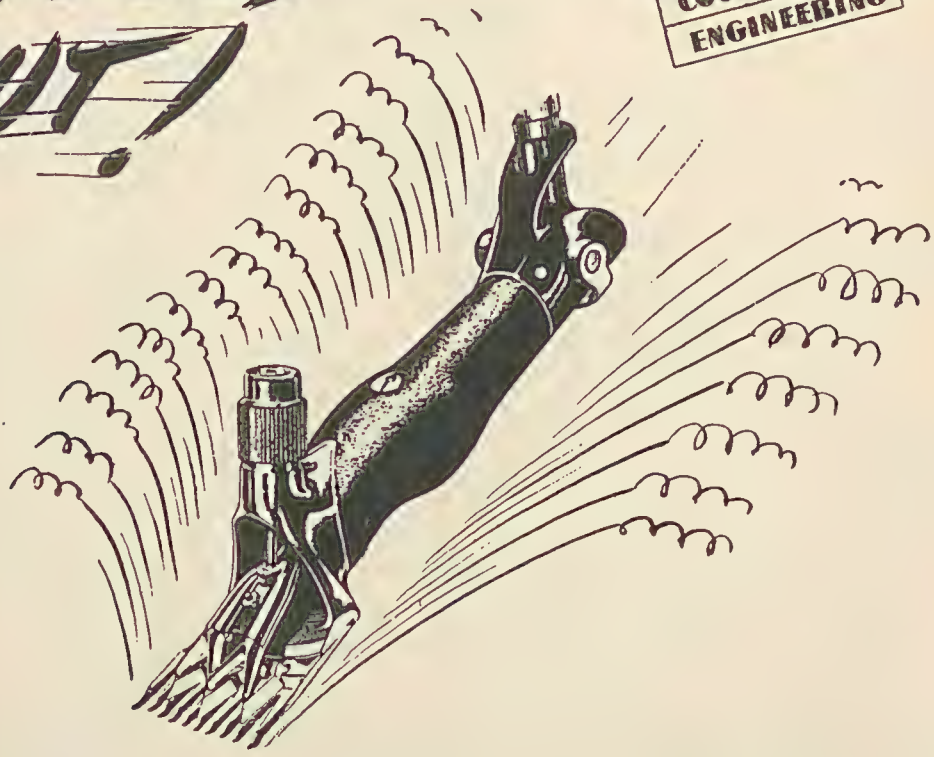

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PASTURE COMPETITION

Lilydale—Yarra Glen District

By R. L. Twentyman, B.Agr.Sc.,
Agrostologist

Entries in the pasture competition conducted by the Yarra Glen Agricultural and Horticultural Society judged last spring gave striking evidence of the wonderful productivity of improved pastures in the Lilydale-Yarra Glen districts. Although little more than 25 miles east to north-east of Melbourne, the district enjoys a 35-in. average annual rainfall, which, no doubt, has had an important influence on pasture improvement.

None of the entries in the competition was on the rich river flats. All were situated on rising land, which, in an unimproved state, carried only poor native-grass pastures. The abundant pasture growth on most of the entries would not have been surpassed on the richest soils in the State, and a survey of the methods adopted by the competitors showed that, in the main, superphosphate and clover had been responsible for the spectacular development.

ALTHOUGH spring pasture growth in the district at the time of judging had again been assisted by favorable weather, it was apparent that the original limitation imposed on the pastures of the district on account of the poor soil, had been overcome in a remarkable manner.

Entries in the competition were restricted to areas of 3 acres only, and, in a few instances, the opportunity that this small area afforded some competitors was taken advantage of, but, in most cases, the areas exhibited were not markedly better than the remainder of the paddock, and it was evident that pasture improvement in the Lilydale district had not been limited to small selected areas, but had been widely and successfully practised throughout the whole district.

Productive dairy pastures are a feature of the Lilydale district.

Perennial rye grass, and usually either subterranean clover or white clover, or sometimes both, were the main components of the pastures exhibited. Little or no cocksfoot was seen, and the bent grass couch which is a common constituent of many of the poorer pastures of the district, was either not present on the strong pastures represented by the entries, or was very inconspicuous at the time of judging.

MARKED RESPONSE TO TOP-DRESSING

The Lilydale district in the past has been reputed to be responsive to dressings of agricultural lime. Departmental pasture trials, conducted in the district, have shown what appear to be worthwhile responses, but it was evident when examining the fertilizer treatment given the entries in the competition, that local farming opinion is not convinced that liming is necessary to the development or maintenance of the pastures.

Some of the pastures, and, in fact, the winning entry itself, had been limed, but most of the pastures do not receive lime. On the other hand, most of the entries had been regularly and liberally top-dressed with superphosphate and the roadside fence provided a sharp line, often contrasting the improved paddocks with the poor roadside pastures. These contrasts were often most striking.

Another practice which has often claimed attention in the Lilydale district is that of underground draining. Irrespective of the benefit or otherwise that this might confer on land thought to require it, the fact emerged from the competition that none of the competition entries was located on land which had been underground drained.

The most conspicuous feature of the pastures exhibited was their vigour. The composition and balance of grass and clover was usually good and generally they were very free of weeds and it was only in regard to their possible utilization that one would feel justified in criticizing any of the entries.

The judging of the entries had been unavoidably delayed and exhibits which might have been in ideal condition at the date the judging should have been done, had become somewhat coarse and overstrong at the time they were inspected.

HEAVY PASTURE GROWTH

Paddocks of grass capable of yielding in excess of 3 tons of dried hay per acre make very impressive entries in competitions, but present a definite problem in management when the time comes to utilize them. In some cases, the heavy growth of grass had commenced to lodge when the competition was judged, and the growth had already got beyond the stage when it would be attractive to grazing stock. Only by the advent of an unusual period of fine weather would it have been possible to cure this material into good grass hay.

The grass-hay harvesting weather this year was exceptionally good, and possibly much of the heavy grass which appeared to present a difficult hay-making problem was harvested in good condition, but, in normal harvesting weather, much of it would have been spoilt before it could be cured. Grass hay cuts of approximately 3 tons per acre usually mean coarse stemmy hay and poor colour owing to prolonged exposure in the paddocks. The subsequent ill effect on the pasture from which it is taken is usually serious.

It is a much better policy to aim at moderate cuts of grass hay—not exceeding 2 tons per acre—and to place emphasis on quality rather than quantity. Taking a very heavy cut of grass hay has a similar effect on a pasture as the cut from a lawn which had been allowed to grow too long. The tall growth suppresses the basal growth, and, in the autumn following the cutting, individual pasture plants will not form a tight close sward. As a consequence, unwanted grasses and weeds can make a ready entry into the pasture and the weakened plants of the exhausted pasture will make poor growth in the autumn and winter.

POTASH

None of the entries showed any signs of potash deficiency and no potash fertilizer had been applied to any of them, but Departmental pasture plots previously conducted in the Lilydale district showed that marked potash deficiencies could readily be induced in pastures that were regularly cut for grass hay. The present high cost of potash and the ill-effects of such a deficiency on pasture land, should be sufficient warning to those who might otherwise be careless of maintaining soil fertility.

It appeared that there was not much wrong with the soil fertility of the paddocks included in the competition, but it is unlikely that this satisfactory state of affairs exists throughout the remainder of the properties. It is reasonable to suppose that the evident abundance of some of the exhibits might have been derived at the expense of some of the back paddocks.

THE AWARDS

In judging the competition, equal points were allotted for apparent productivity, quality, absence of weeds, composition and management. The table shows the points awarded to the various competitors.

First place was awarded to Messrs. W. E. Selman and Sons' No. 2 Entry, an excellent pasture of perennial rye grass with white, subterranean, and suckling clovers. It was dense and even and very free from weeds, and the paddock had benefited from having been built up as a night paddock in the past. Its recent manurial treatment had been 1½ cwt. of superphosphate per year, and, until three years ago, it had received half a ton of agricultural lime per acre every second year. This pasture had developed over the past ten years, and was last cut for hay two years ago.

Second place was awarded to the No. 1 Entry of Mr. D. T. White for a vigorous pasture consisting of perennial rye grass and subterranean clover, with some annual grasses and suckling clover and Yorkshire fog grass. This pasture had been sown after maize seven years ago, and was given a liberal dressing of old grass hay and cow-yard manure at the time of sowing. For the past four years it had received one bag of superphosphate per acre per year, and, at the time of inspection, was carrying a heavy bulk of feed.

Third place was awarded to Mr. N. Houghton's No. 1 Entry of a relatively young pasture, portion of paddock of 129 acres. This pasture had been sown as recently as April, 1946, with perennial rye grass, white and subterranean clovers. Three varieties of subterranean clover had been sown, and, at the time of inspection, plants of the Bacchus Marsh, Mt. Barker, and Tallarook types were distinguishable.

Compared with some of the older paddocks this pasture was somewhat at a disadvantage on account of its immaturity, and it had also been grazed up till the time of inspection. This paddock prior to April, 1946, was rough and tussocky, and had made a vast improvement over a short period—no doubt, having been considerably helped by the recent favorable seasons.

Almost all of the other competitors showed excellent pastures and were worthy of high commendation. Messrs. V. F. Henderson's and A. J. Faulkner's entries were of exceptionally vigorous old pastures, but they had reached a stage when their bulky growth would present a difficult problem in hay-making and were long since past the stage when they could be satisfactorily fed off.

Mr. R. G. Miller's entry was of a young pasture sown in March, 1947. It was mainly of perennial rye grass, clean and free from weeds, but with rather less subterranean clover than is desirable during the early years of building up a pasture on light land.

LIST OF AWARDS, LILYDALE–YARRA GLEN PASTURE COMPETITION.

Entrant.	Productivity, 20.	Quality, 20.	Absence of Weeds, 20.	Composition, 20.	Management, 20.	Total, 100.
W. E. Selman and Sons, No. 2 Entry ..	18	20	18	20	19	95
D. T. White, No. 1 Entry	20	16	19	18	19	92
N. Houghton, No. 2 Entry	15	18	18	18	19	88
N. Houghton, No. 1 Entry	13	18	19	18	16	84
V. F. Henderson	20	16	16	16	15	83
A. J. Faulkner	18	17	17	16	15	83
D. T. White, No. 2 Entry	17	16	15	16	18	82
R. G. Miller	13	16	17	17	19	82
P. H. and W. H. Lawrence	15	17	18	14	17	81
W. E. Selman and Sons, No. 1 Entry ..	20	15	15	14	17	81
Mrs. J. Lawlor	15	15	15	14	14	73

Some of the perennial rye grass was still in rows as sown, the fertility of the ground being insufficient for the plants to thicken up and provide a closed sward.

One twenty-year-old pasture, which had not been "supered" for the past two years, and had been cut for hay in 1947–48, was mainly grassy with very little clover, and more Yorkshire fog and bent grass than was desirable. This pasture also contained some Kentucky blue grass which, like the bent grass couch in this district, is more notable for its persistence than productivity.

At the time of inspection of these entries, Yorkshire fog grass was not very prominent either in the competition entries or in the district generally, but it may have become much more conspicuous since then.

Yorkshire fog grass has become very prominent in the wetter parts of Victoria during the past two years, having been favoured by the prolific seasons and the relative scarcity of stock, and, on some pastures it has recently become so vigorous that it has suppressed the more desirable pasture species. In Victoria, Yorkshire fog grass is largely seasonal in its occurrence, being very inconspicuous in the lean droughty years and aggressive and vigorous in the wet bounteous years. It is always favoured by light stocking, and thickens up alarmingly when the pastures containing a little Yorkshire fog grass are allowed to reach a grass-hay stage and are not cut. Yorkshire fog grass is most troublesome on the poorer soils in the wetter districts, but it will flourish on a wide range of soils provided it is not checked by regular grazing.

Yorkshire fog grass is noted for its poor feeding value when dry and approaching maturity, and, in those districts of Victoria where the winters are wet and cold and the spring flush of feed quickly gets beyond the grazing capacity of the stock, an excess of this grass can greatly reduce the feeding value of a pasture.

When grazed short and growing in association with white or subterranean clovers, it contributes much useful feed in many southern Victorian pastures, but, if it gets out of hand owing to the combination of bounteous seasons and light stocking, it can become a serious pest in a pasture.

Water for Dairy Cattle

The dairy cow needs more water than any other farm animal. The actual quantity consumed will depend upon the foodstuffs eaten, the season of the year, the size of the cow, and the quantity of milk she is producing.

For maintenance purposes, the water requirements of a cow are closely associated with the area of the animal's skin from which perspiration takes place. A large cow, for example, will need more water for maintenance than a smaller cow. Again, a cow giving say, 8 gallons of milk will drink much more water than a cow giving half this amount; the 8-gallon cow will need at least 24 gallons of water daily compared with about 16 gallons consumed by the 4-gallon cow.

A cow will drink more water in summer than in other seasons, of course, and provision should be made to provide her with a plentiful and readily accessible supply.

Cow-yields fall considerably each year at the change of the season—which suggests, among other things, that dairy farmers may not be giving their cows sufficient water when they most need it.

It is very difficult to bring a cow back to her normal milk flow if her yield has seriously diminished during the summer months.

Many keen farmers have installed large concrete troughs in their paddocks where they are readily available for the herd, and increased production has fully justified the expense.

[Contributed by the Dairying Division.]

LIVE STOCK NOTES

Compiled by A. C. T. HEWITT, M.Agr.Sc.,
Live Stock Science Officer

MEAT PRODUCTION, 1948

MEAT production in Victoria for 1948 was not as high as had been expected, and this was mainly due to a big drop in the numbers of sheep and lambs slaughtered. Sheep and lambs have been retained on many farms for wool production and breeding to build up flocks to the numbers grazed prior to the 1943–45 drought. With the very good season, and wool bringing high prices, the incentive is to graze more sheep, and wheat growers are re-stocking with sheep as an insurance against a fall in wheat prices.

The slaughtermen's strike during the normal lamb export season had the effect of forcing some farmers to hold their lambs. Nevertheless, 654,000 lambs were slaughtered in December while the strike was still on, and this number had not been exceeded for any December since 1943.

During the year, approximately a quarter of a million more sheep, but three quarters of a million fewer lambs were slaughtered to produce about 14,000 tons less mutton and lamb than in 1947.

Cattle slaughterings rose appreciably during the year and the increase in beef and veal more than offset the fall in mutton and lamb. The figures show a big increase in the slaughter of calves, young cattle, and cows and most of these are from dairy herds.

Pig meats produced rose another 1,000 tons, and the slaughter of 43,352 pigs during December was the greatest for any month since May, 1944.

The comparative slaughterings for each of the half-yearly periods of the past two years were as follows :—

	January to June, 1947.	July to December, 1947.	January to June, 1948.	July to December, 1948.
Sheep	1,238,000	1,291,000	1,351,000	1,228,000
Lambs	1,016,000	2,525,000	1,047,000	1,789,000
Bullocks	68,000	82,000	93,000	83,000
Cows	108,000	101,000	124,000	111,000
Young cattle	24,000	24,000	30,000	33,000
Calves	96,000	181,000	104,000	207,000
Pigs	186,000	179,000	190,000	183,000

AVERAGE PRODUCTION OF MEAT IN VICTORIA, 1944–48.

—	1944.	1945.	1946.	1947.	1948.
	Tons.	Tons.	Tons.	Tons.	Tons.
Beef and veal	98,000	90,000	93,000	92,000	107,000
Mutton and lamb	156,000	101,000	118,000	107,000	93,000
Pig meats	31,000	26,000	25,000	26,000	27,000
Total	285,000	217,000	236,000	225,000	227,000

Stock slaughtered in 1948 were approximately equal in condition, but a little lighter in weight than those slaughtered in the previous year. Lamb carcasses were lighter by 2 lb. at 34 lb., pig carcasses by 3 lb. at 158½ lb., calves 3 lb. lighter at 58 lb., and young cattle by 10 lb. at 240 lb.

The average production of meat, estimated from figures supplied by the Victorian Government Statist, over the past five years is set out in the above table.

[A.C.T.H.]

PIG PRODUCTION AND PRICES

The monthly supply of pigs to markets, bacon factories, and meat-works in Victoria increased in November, December, January, and February at such a rate as to create a mild glut. The result was a sharp fall in pig prices, and some loss of confidence among pig raisers. It is considered that the condition of the pig market during this period will only be temporary and that, during the remainder of this year, the number of pigs coming forward for slaughter will decrease to an even lower level than in the winter and spring of 1948. Such a decrease in the supply of pigs is expected to be accompanied by price rises at least to 1948 levels.

It is always difficult to forecast the supply and prices of pigs. This is due to the fact that the information on which such a forecast should be based is very limited. The Government Statist publishes details of the pig population on farms as at the 31st March each year. In 1948, the Victorian pig population was 271,492, which was 19,000 less than in the previous year. The number of breeding sows was 5,000 less than in 1947.

Those figures pointed to a lower number of pigs being produced for slaughter during 1948. That was so until November when the number of pigs slaughtered increased rapidly. The actual number of pigs slaughtered in Victoria in 1948 was 373,000, about 8,000 more than in 1947. Victorian slaughterings include some pigs bred in other States.

Farmers used less grain during 1948 (because its price was too high in relation to pig prices), and kept their pigs until the spring and summer and fattened them mainly on milk as it became available.

The increased number of pigs slaughtered in 1948 may have been the result of slaughtering some of the breeding sows, and also small pigs as porkers which, under normal conditions, could have been carried on to baconers for slaughter in 1949. The supply of pigs to market is expected to decline rapidly during the late summer and autumn of 1949.

Changes in the breeding sow population can occur between the annual collection of statistics; the sow population may have changed between March and the spring of 1948.

The relative prices of pigs and grain have been such that the sow population is probably lower now than at March, 1948.

During the winter and spring of 1948, bacon curers competing for their share of the limited number of pigs, forced pig prices to such heights that the processors lost money in selling cured bacon at prices which were controlled by the Commonwealth Government.

When price controls of bacon and ham were removed last spring, the bacon curers increased their selling prices, and the bacon

retailers also increased their price margins. The resulting price increase to the bacon consumers was so severe that consumption of bacon and ham declined and sales were difficult to make.

The dull market for cured bacon and ham coincided with the increase in the supply of pigs for slaughter and, together with labour difficulties at meat works and bacon factories, had the effect of depressing prices paid to farmers for their pigs.

Pig prices receded so far that it became profitable to export pig meats, and appreciably greater quantities were submitted for export under contract to the United Kingdom during December, 1948, January, and February, 1949.

Pigs like these should be carried on to bacon weights rather than be slaughtered as porkers, provided feed is available.

There is free trade in pigs and pig meats between the Australian States, and, therefore, conditions of supply, demand, and price in one State are affected by those of other States.

Working again on the limited information available, it appears that the pig production of Australia will not be very different in 1949 to what it was last year.

In Queensland and part of New South Wales, the pig population and production in 1948 was greater than in 1947 because it included some recovery from the drought of 1946 in these northern States when the breeding sow population was greatly reduced. The same rate of increase in those two States is not expected to continue in 1949, and in all other States there are signs of decreasing pig production.

[L. A. Downey, H.D.A., Pig Expert.]

COPPER AND COBALT DEFICIENCY IN RUMINANTS

Minute amounts of copper and cobalt compounds in the diets of sheep and cattle are necessary for the health of those animals. On much of the coastal region of southern Australia, the soil and consequently the pasture, are deficient in one or both of these elements. Knowledge of the subject has mostly been gained from research work done on areas of deficient country in South Australia and Western Australia. In the former State especially, adequate soil surveys have been carried out to define such areas. In Victoria, however, not enough has yet been done to show the exact location and extent of affected country, although there is sufficient evidence to indicate that symptoms of copper and cobalt deficiency may be found in stock on coastal farms. In addition, there is some suggestion that a copper deficiency may be found in swamp areas similar to those investigated in New Zealand.

Cattle typically develop anaemia and unthriftiness from either copper or cobalt deficiency. In addition, copper deficiency causes a degeneration of the heart muscle which often brings about the sudden death of milking cows. Marked scouring during the spring is found on swamp country. Sheep exhibit the same anaemia and unthriftiness as cattle, and may also develop other symptoms from copper deficiency alone. One of these is a loss of the normal crimp of the wool fibres known as "steely wool". The other is a nervous condition of lambs, which involves one or more legs, and results in a staggering gait known as ataxia. With the exception of the sudden death or "falling disease" of milking cows, all these disorders have been found in Victoria, together with laboratory evidence of a decreased copper content of the blood and livers of affected animals.

The absolute inability to keep stock more than a few months each year on certain areas, as occurred in South Australia, has not been evident in Victoria. A distressing unthriftiness which responded satisfactorily to treatment, however, troubled a number of cattle owners during some

years. In most cases, it appeared to take a few months to exhaust the reserves of introduced animals and of young calves. The latter, if dropped by deficient mothers, have been shown to contain smaller liver reserves of copper and cobalt than normal calves.

Copper sulphate and cobalt chloride are used to supplement the diet on affected properties. Where symptoms are evident, regular drenching is the best method to adopt, the drench being composed as follows :—

Copper sulphate ..	.. 10 oz.
Cobalt chloride ..	.. 2 oz.
Water	.. ½ gallon

Half a pint of this solution is added to 8½ pints of water. This is then given each week for a few months at the rate of half a fluid ounce per sheep, and 4 fluid ounces for a full-grown cow, with smaller doses for young animals.

Top-dressing can be regarded as a long-range control policy, while drenching takes care of the immediate problem. Copper sulphate is used at the rate of 5 to 10 lb. per acre, and cobalt chloride at 1 to 2 lb. per acre every five to seven years. It is advisable to wait for rain before allowing the stock to have access to treated areas.

Drinking water may be treated as follows :—

Copper sulphate ..	.. 10 oz.
Cobalt chloride ..	.. 5 oz.
Water	.. 1 gallon

Half a pint of this solution should be added to 400 gallons of water. The solution should not be added to water in iron tanks or troughs as the iron will throw the copper and cobalt out of solution.

The feeding of treated licks cannot be regarded as a reliable method of dealing with copper and cobalt deficiency.

BURNLEY EGG-LAYING COMPETITION

In conformity with the rules and conditions of the Burnley Egg-laying Competition, it has always been the policy of the Department of Agriculture to accept only those birds which are free from faults and infectious diseases, and which conform to the standard type of the breed.

Entries must comprise pure-bred pullets of any recognized breed not less than five months nor more than nine months of age on April 1st, the day the competition commences. For this year's competition, entries closed on the 1st March.

Accommodation is available for 236 birds, and, if more than 118 entries of two birds each are received, a ballot will be held and those successful in the ballot must pay their fees by the 15th March and deliver the birds to the competition by the 22nd March.

When making the ballot, a record is made of entries which will take the place of those of any applicant who was successful in the ballot, but who withdraws his entries, does not pay his fees, or has his entries disqualified on blood test for pullorum disease or poor conformation.

All birds entered in the competition will be separately handled and carefully examined for crooked breast, side sprigs, wrong feather colour, &c., but difficulties arise with young or immature pullets. The comb of an Australorp pullet which is only partly grown, may not display any irregularities, but, when fully developed, it may become crooked and misshapen, too large, or grow a side sprig.

It is also difficult to avoid variations in body conformation, as the competition is open to poultry farmers throughout the Commonwealth, and, just as there are variations in the type of birds within a breed, at leading poultry shows, similar variations can be expected among the birds entered in the competition.

Most commercial poultry farmers endeavour to breed to a standard type, being principally concerned with birds which will lay a profitable number of eggs. The exhibition breeder on the other hand leans mainly towards type.

In order to try and attain a more uniform type in this year's competition, the accepted entries must be at Burnley by the 22nd March. This will allow ample time for the birds to settle down so that a careful check can be taken for type, &c., before the commencement of the competition.

Competition records have shown that winning birds rarely possess outstanding qualities for both show type and high-egg production, but this does not mean that strenuous efforts should not be made to combine both factors in poultry flocks throughout Victoria.

[M. D. HALL, Poultry Expert.]

DAIRY PRODUCTION

Milk production in Victoria in the early spring was lower than in the same period of 1947, but the season improved, and, by December, 1948, total production for the six-months period, July to December, 1948, more than equalled that of the previous year.

Production has remained at a high level throughout January and February and, as there are big reserves of fodder and good autumn feed in the paddocks, the 1948–49 season will be a good one for the dairying industry.

Production throughout Australia for the six months ended December, 1948, is set out in the following table. All States except South Australia showed an increase. The biggest increase was in Queensland with 4·2 per cent., and, for the Commonwealth the total increase was 1·8 per cent.

—	Butter.	Cheese.	Whole Milk. Total Production for all Purposes.
	Tons.	Tons.	Gallons.
Victoria	36,055	11,528	263,765,000
New South Wales ..	15,111	1,209	137,497,000
Queensland ..	20,917	4,746	125,916,000
South Australia ..	5,620	8,463	56,839,000
Western Australia ..	5,340	736	35,817,000
Tasmania	2,779	206	20,325,000
Total ..	85,822	26,888	640,159,000

THE REMOVAL OF BEES FROM DWELLINGS AND FARM BUILDINGS

If bees have invaded a house, or taken up their abode in farm buildings, it is wise to get in touch with an apiarist to deal with the situation.

Contrary to general belief, bees in buildings are not of much value, and apiarists would not be interested in buying them. The charge for their removal is about 5s. per hour, and involves a fair amount of specialized labour. If the bees are situated between the studding in a standard weatherboard building, the boards will have to be removed.

The extreme edges of the nest can be located by boring a hole an eighth of an inch in diameter, through the outside wall. This will make unnecessary the removal of much of the wall.

Tools required for the job are bee veil, smoker, hammer, chisel, pinch bar, pad saw with blade, screw driver, brace and bit, long-bladed knife, and water.

After locating the limits of the nest, commence operations by removing the board close to the bottom of the bee cluster. Insert a screw driver and pinch bar so that it allows the nails to be cut with the pad saw. This will prevent injury to the boards. When the nails have been cut, insert the knife flat against the board and cut the adhering comb away.

Remove the board and work up the wall until the nest is exposed. If the bees are inclined to sting, use a little smoke. As a rule the bees will move up the wall, and off the combs if they are smoked a little from the bottom of the nest. Too much smoke often disturbs them unduly, causing them to crawl everywhere. Cut the comb away, and brush off any bees adhering to it. Dispose of the comb by burning.

The ideal time to operate is when bees are flying well; preferably in the forenoon. After removing the combs, leave the bees a full day to clean up. They will form a cluster, and, if exposed, they can be dipped off the wall by using a pannikin or fruit tin. Start at the bottom of the cluster and gently work up. When the dipper is full, place the dipped bees into a box placed nearby. Make sure that the queen is removed with the bees as they will return to the wall if she is left behind.

In many cases, the bees will move to the highest part of the wall when the combs are removed, and establish themselves in a new position if left unmolested. If this should happen they may be ejected by smoking them vigorously, or, if this fails, by placing rags soaked in phenyle or carbolic acid into the position they occupy. The soaked rags can be wrapped into a ball on lengths of No. 8 wire, and held in position.

This method will usually displace a swarm that has recently taken up its abode in a building, but it is of no use when the colony has established itself, and contains brood.

When replacing the boards, be sure to make them bee-proof, as another swarm may enter the cavity at any time.

[W. A. Collins, Senior Apiary Inspector.]

"GREENFEAST" PEA SEED

Approved Growers

By R. F. Henderson, B.Agr.Sc., Horticultural Instructor

BECAUSE of the unsatisfactory supply of reliable, pure-strain pea seed available to green-pea growers in Victoria, the Department of Agriculture is continuing its scheme of supervising the production of Approved Garden Pea Seed in the Western District. The object of the scheme is to give pea-growers supplying the Melbourne and provincial markets an opportunity of purchasing good seed.

Since the scheme was put into operation during the 1945–46 season, a large quantity of excellent seed has come forward from Western District seed growers and many favorable reports have been received from green-pea growers who have used this locally-grown seed.

The seed crops are grown from mother seed that has been carefully "rogued" for five seasons and consequently a pure strain has been developed. This work is conducted by experienced officers in the field who closely inspect the crops for "rogues" and disease. Crops that do not reach the required standard are rejected. The harvesting also is supervised.

The popularly grown "Greenfeast" is the main variety approved and the strain produced is a high-yielding type capable of several pickings. It has a deep-green foliage and the pods, borne mostly in pairs, are large, well-filled with typical curved end. These pods retain their green colour during transit to market. The seed has also been used successfully for the production of canning peas. Yields, of course, will vary with the time of sowing, soil, and weather experienced during the growing season.

This season, over 3,000 bushels of approved seed of high laboratory germination are available to pea growers from the seed growers listed on this page. The price of the seed is expected to be in the vicinity of 40s. a bushel.

The attention of the Department has been drawn to numerous poor crops grown from imported seed, particularly during the last two seasons. To ensure the supply of better seed, a number of experienced pea-seed growers in the Western District have been encouraged to increase their production, and it is, therefore, recommended that Victorian pea growers should take this opportunity of buying locally-grown seed which has been proved to hold its own against any other pea seed. Growers of market peas in the main pea-producing areas of Gippsland, Western District, Bellarine, Mildura, Red Hill, and the Dandenong Ranges have all reported good results with Approved "Greenfeast" seed.

Approved seed may be easily distinguished by the sealed bags and the Departmental "Approval" label on each bag. All seed is tested and germination results may be obtained on application. Any further information can be obtained by writing to the Horticultural Division, Department of Agriculture, Treasury Place, Melbourne, C.2.

Growers are strongly recommended to dust, before sowing, all pea seed with "Tetroc", as this treatment helps to protect seed against rotting organisms in the soil and therefore assists a good "strike".

GROWERS OF APPROVED PEA SEED FOR 1948–49 SEASON. VARIETY: "GREENFEAST."

Grower.	Address.
Bennett, L. W.	Berry Bank
Kavanagh, Chas.	Warrnambool
Lane Bros.	Killarney
Nagorcka, P. C.	Moutajup
Noske, P. J., and Son	Moutajup
O'Brien, B.	Port Fairy
Pargetter, E. H.	Strathkellar
Pye, T.	Bessiebelle
Sharrock, R. J.	Bessiebelle
Shurmann, E.	Moutajup
Speirs, F. C.	Nalangil
Taylor, J. A.	Barwon Downs
Thomas, W. A. and W. D. ..	Bessiebelle
Urbergang, A.	Yambuk
Watts, T.	Yambuk

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broken
drills and
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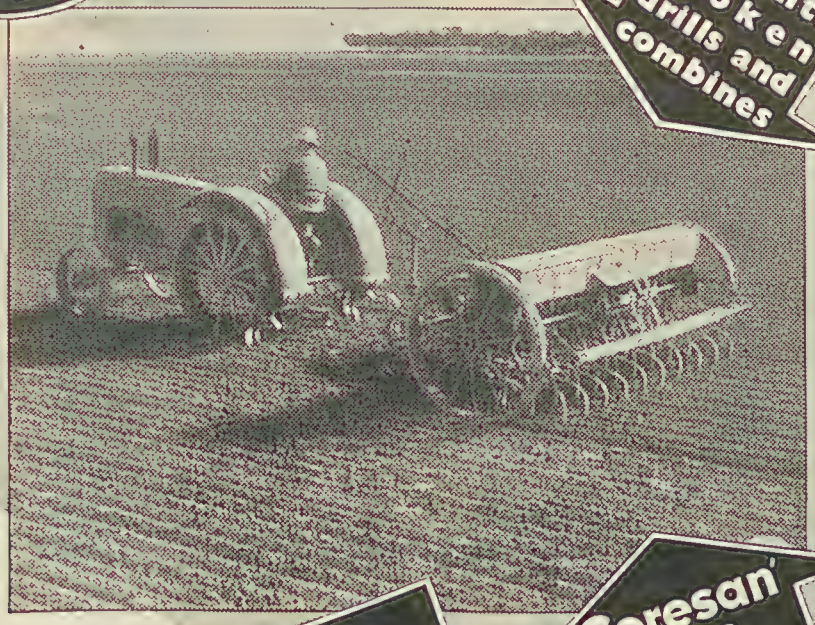

'Ceresan'
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smoother flow
of seed

for . . .
BETTER SOWING
BETTER GERMINATION
BETTER STAND OF PLANTS
BIGGER YIELDS OF
BETTER GRADE GRAIN

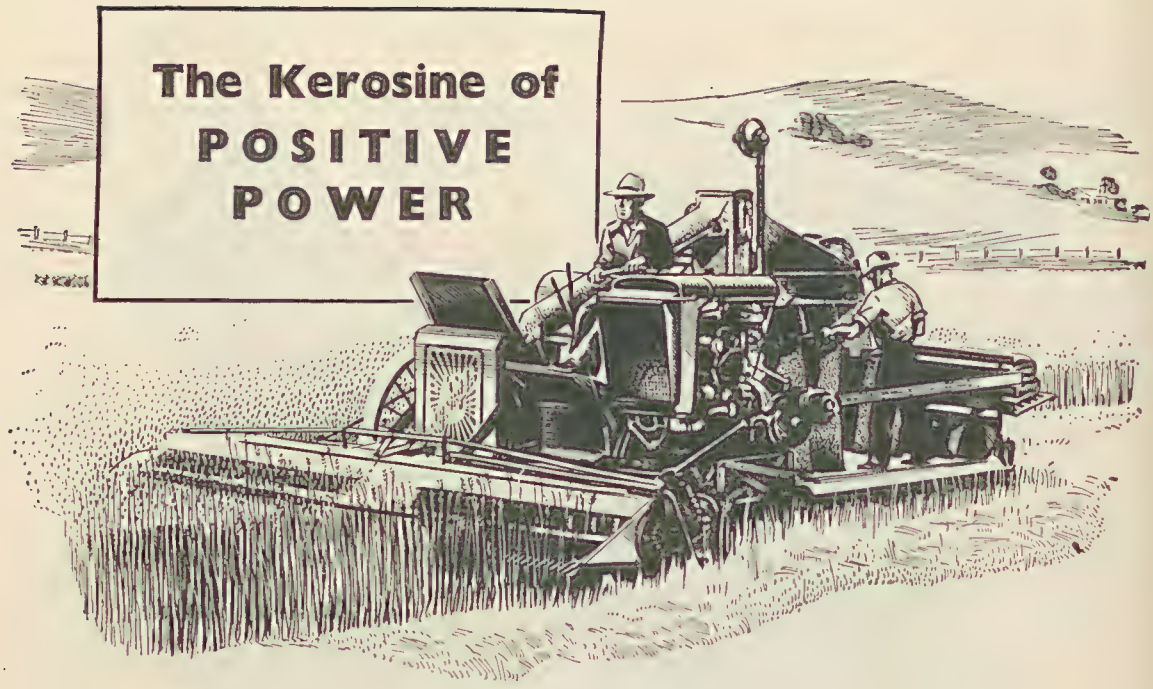
Pickle with

'CERESAN'

BAYER'S DRY SEED DRESSING

BAYER

THE BETTER DRY SEED PICKLE



The man on the land must investigate and use every avenue for making money and saving money. Cross kerosine saves you money because *every drop* goes to work. There's no waste. Cross vaporises completely, turning all of the precious fuel into positive power. Your tractor responds to this better fuel by doing a bigger job on less gallons per day. And, because of the higher quality of Cross, engine overhauls are not so frequent. Use Cross Power Kerosine in your tractor and Shell Motor Oils for the perfect lubrication of every part that moves. You'll be handsomely repaid. Call, write or telephone your local Shell Depot or Agent for your supplies.

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Principal Diseases of Lemons in Victoria and Their Control

By H. A. J. PITTMAN, B.A., B.Agr.Sc., Dip.Ed., Plant Pathologist, Biological Branch.

THE principal diseases of lemons in Victoria, commencing with those that affect the root system and base of the tree, and proceeding upwards, are as follow:—Armillaria Root Rot; Collar Rot; Brown Rot; Shell Bark; Anthracnose; Citrus Pit; Septoria Spot.

Following is a brief description of the symptoms of these diseases and a summary of the methods used for their control.

Fig. 1.—Portion of citrus root showing black rhizomorphs of Armillaria root-rot fungus partly embedded in the tissues.

Fig. 2.—Typical mushroom-like fruiting bodies of the fungus developing on citrus root.

ARMILLARIA ROOT ROT

Armillaria root rot is caused by attack on the root system, and finally on the crown of the tree, by the indigenous, mushroom-like fungus *Armillaria mellea*. This fungus occurs on the roots of various species of eucalypts. In the case of orchard trees, rose bushes, blackberries, raspberries, rhubarb, and potatoes, it frequently causes a serious root or tuber rot, which, if neglected, ultimately leads to the death of the tree or bush.

Fig. 3.—Collar rot of lemon tree.

Armillaria root rot usually originates through rushed planting of orchard or nursery sites, involving the inadequate removal of roots, branches, and stumps of native trees and scrub. From such infected material, the fungus sooner or later moves on to the living roots of domesticated plants, where it occurs in the form of long, black, boot-lace-like structures from which fungal strands penetrate the bark to the cambium region, where white mycelial fans with a mushroom-like smell radiate in characteristic fashion.

Ultimately, large mushroom-like fruiting bodies, creamy brown on top of the cap and with permanently white gills, may develop at the bases of trees seriously weakened or killed by the disease.

Affected trees may take years to die, their death being preceded by a progressive yellowing of the foliage, a cessation of strong vigorous growth, much twig dieback, heavy blossoming, and heavy setting of fruit, which is, however, usually smaller in size and poorer in quality than previously.

While the original infected tree is slowly passing into a decline, if the trouble is not properly diagnosed and adequately treated, other trees in the vicinity may become infected, so that, in the course of time, serious mortality may occur over an ever-extending area, which may be approximately circular, or markedly irregular in outline.

COLLAR ROT

Collar rot is the most frequent cause of death of lemon trees in southern Victoria. The disease is caused by attack on the bark in the "collar" region, namely, the region where the butts of the main roots and the base of the stem fuse at ground level, by one or more of a number of soil-inhabiting organisms. These are frequently introduced with the soil supplied with the young trees, but may already be present at the new site, and may do little, if any, harm, unless the soil conditions are made unusually favorable to the organisms, and unfavorable to the roots, by overwatering, bad drainage, or unusually protracted periods of wet weather.

Attention is usually first drawn to the trouble by the yellowing and sparseness of the foliage, and the cause is readily diagnosed by scraping away the soil at the base of the stem, where cracking and scaling off of the bark in this region, with or without gum formation, will be seen. In the long run, if untreated, the tree is "ring-barked" by the disease and will die.

Fig. 4.—Brown rot gummosis on citrus tree. Gum is exuding from the trunk.

BROWN ROT

As usually recognized, Brown Rot is primarily a disease of the fruit and leaves, caused by one or more soil-inhabiting organisms. On the *fruits*, light greyish to brown discoloured patches occur, usually without any sharp margin, and sometimes covering half of the surface of the fruit. A very pleasant and characteristic perfume is frequently associated with the lesions. Affected fruit is useless and readily falls.

Fig. 5.—Brown rot on lemon fruits. These specimens were taken from a Ringwood grove.

On the *leaves*, dead brown areas occur, usually commencing at the tips, with the leaf then rolling inwards towards the mid-rib and frequently falling to the ground while the greater part of the leaf is still quite green. Marked defoliation may be caused by the disease during periods of cold, wet weather with driving rains, leaving the fruits hanging conspicuously on the more or less bare branches. The disease, usually inconspicuous in the summer months, normally appears each winter on fruits and leaves on the lower branches, and works towards the top of the tree, sometimes in a funnel-like manner. It is frequently most serious on the south, or south-western, side of the tree.

SHELL BARK

In the Murray River Valley, particularly at Cobram, and also at Wangaratta, a condition is sometimes found on the trunk of lemon trees, commencing just above the bud union, in which the bark cracks and flakes. This trouble is similar to that known as Shell Bark in California. For some years, growers have adopted the practice of scraping away the affected bark and painting the area with Bordeaux paste as recommended for the treatment of Psorosis or Scaly Bark on oranges, and have observed that new bark forms again. There is usually a recurrence of the trouble in the course of time, when further similar treatment is required.

ANTHRACNOSE

Anthracnose frequently causes death and falling of leaves in a manner similar to that caused by Brown Rot. In addition, light-brown to dark-brown discoloured areas may be caused on the rinds of citrus fruits, of which fully ripe navel oranges are particularly subject.

On oranges the lesions are frequently developed most abundantly at the stem end of the fruit, and considerable "tear staining" may be present, but this feature is rare on lemons where numerous, small, dark-brown spots, or a single very large lesion, are much more usual.

The affected areas are often sharply marked off from the healthy portions of the rind, frequently becoming slightly shrunken below the level of the uninjured skin. They have no smell, and extensive areas of skin may be affected, with, at first, little deterioration of the inside of the fruit. The "tear-staining" effect on oranges is frequently seen on fruits located immediately below a dead fruit-stub.

The fungus is a normal inhabitant of dead twigs and other dead tissues in citrus trees, but usually does not become seriously parasitic on the fruits or leaves until there has been a marked decline in the general health of the trees from other causes Frequently unbalanced or inadequate manuring, or the onset of zinc-deficiency symptoms (Mottle leaf), or attack by other parasitic agencies such as Armillaria root rot, collar rot, or Phytophthora root rot, precedes a serious development of anthracnose on the fruit.

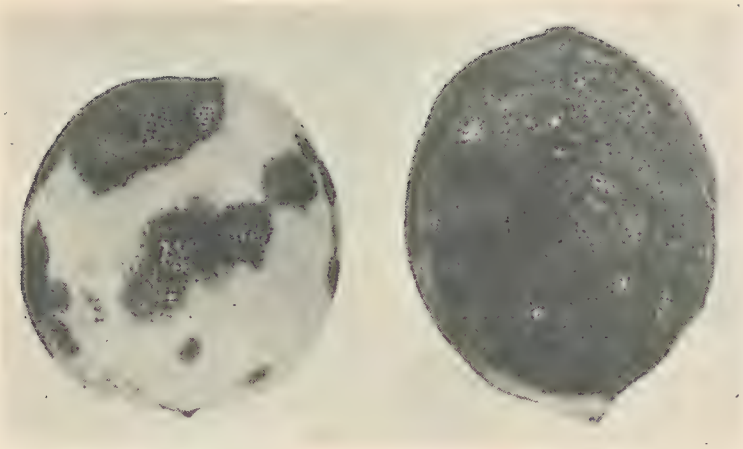

Fig. 6.—Anthracnose on lemons.

CITRUS PIT

Citrus Pit is a bacterial disease of the rind. The responsible organism is essentially a wound parasite, making its entrance into the outer layers and rag of the peel through wounds made by hail, thorns, dead twigs, and insects.

The disease is usually recognized by the sunken areas in the skin, with a steep and sharp line of demarcation from the uninjured portions. The lesions may be grey in colour, light to dark brown, or almost black, and frequently show a fairly clear-cut break in the skin through which invasion of the organism has occurred. The flesh of the fruit is not attacked. Leaves and twigs may be blackened and killed back, causing a condition known as Citrus Blast. The disease is most frequently in evidence in late winter and early spring.

SEPTORIA SPOT

In occasional years, when summer rainfall is above normal, or in early autumn before the fruit is mature, oranges, lemons, and grapefruit in groves along the Murray Valley may develop various types of spots and small pits, associated with attack by *Septoria sp.* This trouble has been known for many years as Septoria Spot.

The spots are usually present on the fruit while it is still on the tree. They appear in the form of very small depressions or pits about 1/25 inch to 1/12 inch in diameter, and extending not deeper than the oil-bearing portion. The spots often begin when the fruit is green, but become most conspicuous when it ripens.

At the base, the depressions are light-brown or buff in colour. As the skin loses its green, a narrow zone around the spots remains greenish for a short period, but finally becomes reddish to reddish-brown. Occasional larger pits may become dark brown or black, up to rather more than ¼ inch in diameter and sunken deeper into the rag of the skin. Very small, black, fruiting bodies, containing long, narrow, needle-like spores develop in relatively few of the pits.

The trouble is particularly common on lemons in inland areas and may cause considerable spotting and dropping of the leaves. Under Victorian conditions, the disease is of spasmodic occurrence, and is of little consequence in the southern (lemon-growing) portions of the State.

GENERAL CONTROL MEASURES FOR DISEASES OF THE LEMON

ARMILLARIA AND COLLAR ROT

Firstly, as a precaution against Armillaria, the land to be planted should be carefully cleared of all old roots, stumps, and large branches of the original native flora. Several years should be allowed to elapse between the cutting down of native trees or scrub, and the planting out of young fruit trees. During this period, it is a good plan to grow pasture or vegetable crops on the land, but not potatoes or rhubarb, as these may be attacked by *Armillaria.*

Any pieces of sawn timber, old fence posts, or the like, should be carefully removed from the site, and no timber or brush drains permitted as all of these may be attacked by *Armillaria.* The fungus may spread from such infected material on to the roots of citrus, or deciduous fruit trees, or flower-garden plants of various kinds.

To ring-bark the original vegetation and allow it to die out slowly, so that the starch

content of the roots may be largely exhausted in the process, greatly lessens the risk of attack by this fungus disease.

As lemon trees develop into mature plants, great care should be taken to see that soil, water, organic matter, or fertilizers are *kept well away from the base of the tree*, and never applied closer than 18 inches to the base of the trunk.

For the prevention of collar rot, and the crown rot phase of *Armillaria* attack, it is advantageous to plant young lemon trees on a slight mound, rather than "on the flat", or in a depression. Drainage will then be away from, and not towards, the "crowns" or "collars". Where the soil is thrown up about the base of the stem, collar rot almost invariably develops and may destroy the tree if the condition is not promptly noticed and proper remedial treatment applied.

Where a tree is suffering from *Armillaria* root rot or collar rot infection, cut off diseased roots and remove all diseased bark and wood with a sharp knife or curved scraper, until only healthy tissue is exposed all round, and below, the lesion. Then remove the soil to form a saucer-shaped depression some 3 feet in diameter, and 9 inches deep at the centre near the trunk. *This depression should be left open indefinitely.* Paint any wounds with home-made Bordeaux paste, prepared by dissolving 1½ oz. bluestone "*fines*" in ½ pint water in a glass jar, and 3 oz. freshly-hydrated lime in another ½ pint water. Mix the two materials together to form a thick blue paste which can be applied with a brush to the wounded area.

In the case of Armillaria root rot, any diseased roots should be followed up, outwards from the trunk, and burnt. For *Armillaria*, too, sulphate of iron solution, at the strength of 1 lb. in 5 gallons of water, using some 15 to 20 gallons for large trees, may be poured into a saucer-shaped depression around the trunk of the tree some 3 feet or so in radius. Additional sulphate of iron crystals are sprinkled evenly over the undisturbed area beyond the saucer-shaped depression, and extending well out into the space between adjoining trees, at the rate of 3 to 4 lb. to each well-grown tree.

After the water in the depression has seeped away, the earth should be filled in, with the exception of an area about 1 foot in radius and 9 inches or so in depth around the trunk. The tree should thus be left suspended on the butts of the main roots, under and about which air should be free to circulate. This depression should be left open indefinitely, to allow plenty of light and air to get at the base of the tree.

The sulphate of iron treatment for *Armillaria* control is best given in the autumn and spring, although it may be successfully used at other times also, *provided the trees are not suffering from lack of* moisture. The rain or irrigation will carry in the sulphate of iron which has been sprinkled dry beneath the branches or between the trees.

Any *Armillaria* mushrooms may be sprinkled lightly with sulphate of iron as soon as noticed, to kill them and prevent the dissemination of spores or fungal seeds.

Inarching of young seedling citrus trees, or bridge-grafting across large wounds, using suitable citrus scions, may be used to help rejuvenate large trees on which surgical operations have been extensive.

CONTROL OF BROWN ROT, ANTHRACNOSE, AND CITRUS PIT

For the control of Brown Rot, Anthracnose, and Citrus Pit simultaneously, the following procedures are important:—

As much dead wood as possible should be removed by periodic pruning, and, where live branches are overcrowded, the excess branches should be removed to allow greater freedom of air movement, and the penetration of light through the tree. All large wounds made in these operations should

Fig. 7.—Citrus pit on lemon. Note obvious break in the skin in the largest lesion.

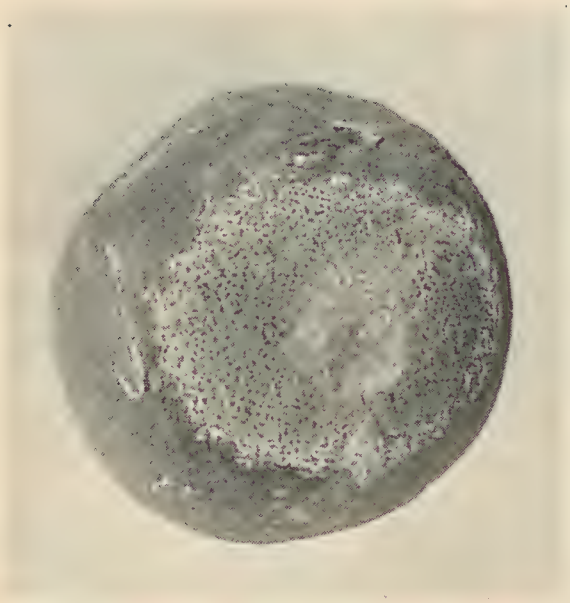

Fig. 8.—Orange fruit affected with blue Contact Mould.

be painted over, and be kept covered with good quality white-lead paint, bituminous paint, Stockholm tar, or Bordeaux paste, to prevent the entrance of wood-rotting fungi.

The provision of adequate shelter from strong winds, by the growth, or erection, of wind-breaks, will greatly contribute to the reduction of losses from Citrus Pit by reducing wounding of the fruit, and will reduce disfigurement from mechanical abrasion known as Wind Scurf.

To inhibit Brown Rot, cut back any branches which make contact with the ground, as the fungus usually gains access to the leaves and fruit from the soil, and the greater the gap between fruit and leaves and soil the less the danger of contamination. Cutting back these branches will allow greater air circulation beneath the tree, with consequent reduction in humidity; and the suppression of weed growth beneath the tree will also be advantageous for the same reason. Cover crops should not be allowed to grow up into a dense mass entangled in the branches of the trees.

Spraying

The trees should be sprayed in the late autumn or early spring with 3 : 3 : 50 home-made Bordeaux mixture, plus ½ gallon prepared white spraying oil to each 50 gallons of spray. When spraying, it is important to see that the bases of the main stems, and the whole of the main trunk, *and the ground beneath the tree*, receive an application of the spray.

Mid-April or mid-August, and, in some cases, both periods, would be most suitable for the application of Bordeaux sprays.

All fallen fruits should be gathered frequently and destroyed. If this is not done, the respective parasites present breed in the fallen fruit, which also may become affected with Blue contact mould (*Penicillium italicum*) and/or the Green Mould (*Penicillium digitatum*), so that storage of sound fruit becomes a problem.

CONTROL OF SEPTORIA SPOT

Septoria leaf and fruit spot may be controlled by spraying with home-made Bordeaux mixture at a strength of 3 : 3 : 50, in the late summer or early autumn.

At this point a warning may be issued. *Never fumigate citrus trees with cyanide after spraying with Bordeaux mixture, until at least six months has elapsed.* If this is done, a copper cyanide, poisonous to citrus trees, may cause serious injury to the trees. Alternatively, spraying with Bordeaux mixture may be carried out a fortnight *after fumigation* without harm.

For Collar Rot, Shell Bark, or wound treatments, in districts where cyanide fumigation is carried out, growers are advised to use a paste of 1 lb. zinc sulphate, 1/5th lb. copper sulphate, and 1 lb. of fresh hydrated lime to 1 gallon of water, instead of the usual formula for Bordeaux paste, in which considerably more copper sulphate, and no zinc sulphate, are used.

IN THE ORCHARD

By G. W. Gayford, B.Agr.Sc., Senior Horticultural Instructor

RABBITS AND HARES

WITH the present shortage of wire-netting, fruitgrowers with new trees or replants in infested areas may suffer loss of trees due to damage by these rodents. Other animals which sometimes cause damage to young orchards, particularly on the borders of new plantings, include wallabies and deer.

New shoots and buds on young trees are attractive and accessible to rabbits and consequently it becomes difficult in rabbit-infested districts to obtain establishment of balanced frameworks.

A simply-constructed tree-guard used in a Redcliffs citrus grove for the protection of young fruit trees.

Methods such as tying straw or rushes around the young trees protect the bark, but not the buds. Pieces of wire-netting may be used in a circle 15 inches in diameter around each tree and held in position with a stake.

A simple tree-guard made by Mr. R. D. Hollins, of Redcliffs, for the protection of young trees in his citrus grove is shown in the accompanying illustration. The guard is of a type which could easily be prefabricated on wet days from waste material which is available on most orchards.

Old case timber is wired together as pictured, and, between this timber, two stakes, roughly sharpened to a point, are placed on either side. The guard is placed around the tree and held in position by driving the two sharpened pieces of wood firmly into the ground.

Repellents

Various mixtures for application to the trunks of fruit trees, with a view to discouraging rabbits from attacking them, have been tried with varying success. Several mixtures are given hereunder :—

(*a*) 1 oz. bitter aloes and 1 lb. of soap dissolved in 1 gallon of water.

(*b*) Heat 1 gallon of linseed oil to 470 deg. F., or until bluish vapour is given off. Remove from fire and add slowly, stirring constantly, 1 oz. at a time, of powdered sulphur to make a total of 12 oz. This preparation should be made out of doors because of the noxious odour and the risk of fire.

(*c*) A report in the Year Book of the United States Department of Agriculture (1943–47) describes a material which was evolved after hundreds of mixtures were tried by the Forest Service, Soil Conservation Service, and State Fisheries and Game Departments. This material is known as "96A" and consists of copper carbonate, copper sulphate, dry lime sulphur mixed into a solution of synthetic resin and asphalt emulsion dissolved in ethylene dichloride. This mixture proved to be an effective repellent when painted on the bark of fruit trees during the dormant period.

INFECTIOUS LEAF VARIEGATION

As usual at this time of the year there are many enquiries concerning the leaf disease of apple trees known as infectious variegation. The variegation takes several forms.

In some cases it is an irregular mottling and in others the pale marking follows the veins.

It is known that the disease is a virus which can be spread by budding or grafting, and, as there is no control once the disease is established, trees free of the disease should be marked as a future source of grafting wood.

BORERS IN FRUIT TREES

Except for the root borer and the elephant beetle larva which cause widespread damage in lemon trees in southern Victoria, damage from other wood borers is comparatively insignificant. Occasionally, however, native wood-boring insects attack fruit trees.

Control is difficult, but coating the trunk and limbs with Bordeaux paste will have a repellent effect. This paste is made by dissolving 1½ lb. bluestone in 1 gallon of water in a non-metallic container, mixing 1½ lb. slaked lime in 1 gallon of water and combining the two solutions.

Where a grub has bored into the tree the hole may be probed with a piece of soft wire to destroy the grub. Another method is to pour a few drops of carbon disulphide or kerosene into the hole, which should then be plugged with grafting wax.

LIGHT-BROWN APPLE MOTH

Some of the worst damage to apples due to the light-brown apple moth occurred last year just before harvest. Apple growers should keep on the watch for signs of grub damage, and, if necessary, apply a lead-arsenate spray. The adult grubs resist lead-arsenate sprays so that constant inspection of the apples for the small green grub is advisable at this time of the year.

Book Review

Science and the Glasshouse, by W. J. C. Lawrence

(Publishers : Oliver and Boyd Limited, Tweeddale Court, Edinburgh 1.)

NO one interested in the growing of plants under glass should fail to read this book, and anyone contemplating the building of a glasshouse would be unwise to miss it. Lest the title should suggest that this is a book about scientific principles and of only indirect interest to the practical man, this reviewer assures prospective readers that it is a very practical volume by one who has had very considerable practical, as well as scientific experience as a responsible member for many years of the staff of the John Innes Horticultural Research Station.

Part 1 deals with soil preparation for the glasshouse ; Part 2 deals with the handling of plants and the choice of potting mixtures, while Part 3 deals with construction of the glasshouse, including its siting to obtain optimum lighting conditions.

When this reviewer visited the John Innes Station last year, he found that it was being moved from its present inadequate site to another site in England, where it will probably become the Empire's centre for glasshouse work. Thus the author is in a particularly favorable position to command the subject on which he writes.

FRANK M. READ.

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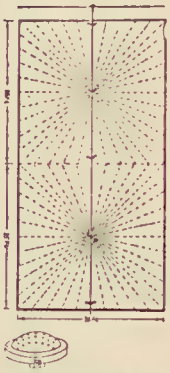

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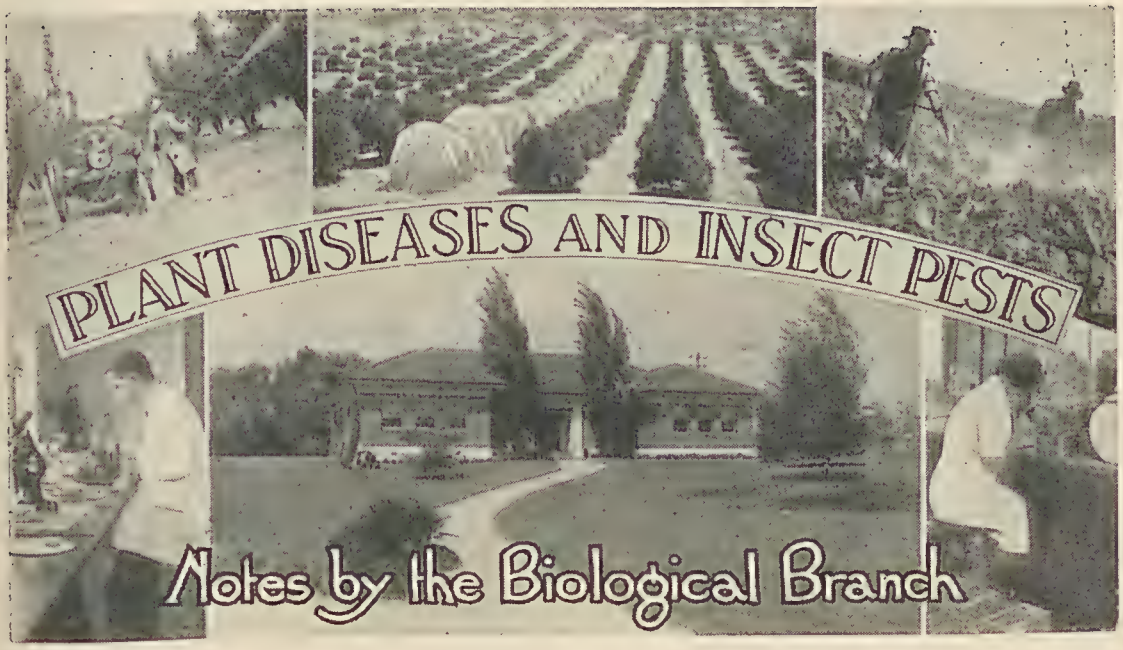

CORM ROT DISEASES OF THE GLADIOLUS

The widespread cultivation of the gladiolus in recent years has brought with it a number of serious diseases, some of which can result in disastrous losses. These diseases, however, may be controlled, and growers are advised to make themselves acquainted with the symptoms and the methods appropriate to prevention. Unless precautions are taken, devastating losses can occur, particularly during the storage period of the corms.

SYMPTOMS OF THE VARIOUS CORM ROTS

Bacterial Scab (pathogen *Bacterium marginatum*)

This trouble causes black lesions on the bases of the husks. On the corms, there are more or less circular pits or depressions having a slightly raised margin. These are frequently covered with a thin, horn-like skin mixed with particles of earth. In the pits, a dried bacterial exudate is sometimes seen. Leaves may develop more or less circular or elongated reddish-brown spots with a slightly darker margin. At first these are a pin's point in size, but may be very numerous.

Sometimes a destructive neck rot of the young plant may be caused. The disease is greatly encouraged by bad drainage.

Hard Rot *(Septoria gladioli)*

Hard rot causes dark-coloured corm lesions which have a very irregular outline, no

Fig. 1.—Bacterial Scab. Left: Corm showing tattered appearance of husks. Right: Corm with circular craters.

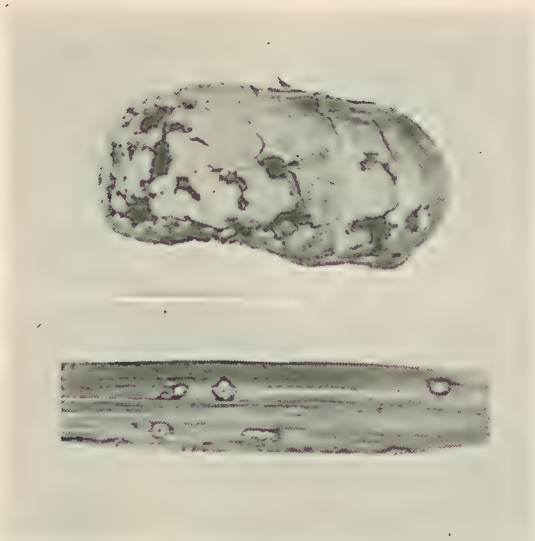

Fig. 2. — Corm affected with Hard Rot. The irregular, sunken lesions are typical of the disease. The section of leaf illustrated has also been attacked by the fungus.

prominent rim, may be much sunken and somewhat greasy in appearance. They frequently appear to follow the lines of attachment of the husks. The lesions may be present at time of harvesting, but newly-infected corms may show little or no evidence of disease, and the husks themselves are usually free from any signs of infection.

Leaf spots, circular or oblong in outline, and brownish in colour with ashy-grey centres, may occur. These spots contain the small, black, fruiting structures of the fungus, and may be very numerous. Under moist conditions the spots may enlarge and involve most of the leaf margin.

Botrytis Core Rot

Botrytis core rot results in the development of a rapidly-advancing, more or less moist-looking soft, olive-brown rot, at first firm and then later shrinking and becoming dry and corky. Usually the rot proceeds up the core region which is completely destroyed. Under moist conditions, a dense white external mycelium, giving rise to a black encrusting growth, forms on the outside of the affected tissues. This black structure is the resting stage or sclerotium of the fungus. Affected corms finally dry out and become hard and mummified.

Leaf symptoms are reddish-brown spots, often very numerous, which may finally involve most of the leaf area. Infected flowers develop light-coloured spots on the petals, which wither and become brown. On the infected flowers, leaves, and corms, under favorable conditions, the characteristic "grey mould" appearance of the fungus, looking under a strong hand lens like a miniature bunch of grapes, on a long stalk, may develop.

Dry Rot *(Sclerotinia gladioli)*

Dry rot causes numerous, but small, irregularly-shaped, more or less separate, blackish lesions on the corms. These are particularly numerous along the lines of origin of the covering scales. Brittle, dark-coloured areas may occur on the husks, and a neck rot may be caused on young plants about six to eight week's old, with the leaves commencing to yellow from the tip, finally drying and falling over. Small black bodies, the minute sclerotia of the fungus, may occur in the dead tissues.

Penicillium Corm Rot

This disease, due to *Penicillium gladioli*, is a storage disorder, and is most severe on corms which have been injured. Care in handling the corms is important in reducing it to negligible proportions.

The fungus causes a soft rot on the side of the corm, which may penetrate fairly deeply. The affected area later dries out and becomes leathery in appearance. A large number of irregular, small, tough, dark-brown patches on the surface of the corm, may indicate extensive infections.

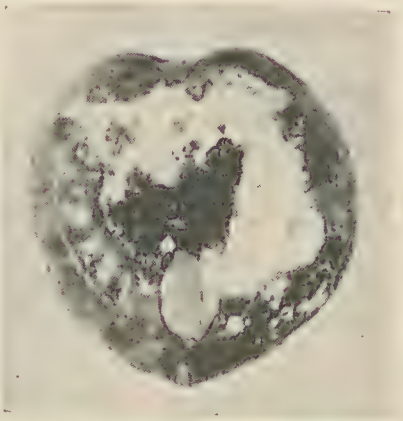

Fig. 3.—Botrytis Core Rot, infected corm. Note the white mycelium of the fungus and black resting bodies (sclerotes) at the centre of the corm.

Pinkish-buff resting bodies, or sclerotia, may occur on the surface, and, under moist conditions, bluish-green spores of the fungus may also develop.

CONTROL MEASURES

Dipping the Corms

Steps should be taken immediately following lifting of the corms to prevent infection with *Botrytis sp.* (probably *B. gladioli* Kleb.) which is, perhaps, the most devastating gladiolus disease in storage, under local conditions.

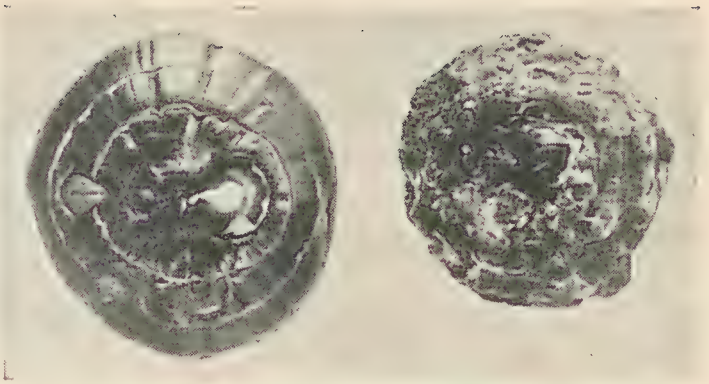

Fig. 5.—Botrytis Core Rot. Left : A slightly-infected corm. Right : A corm in a mummified condition.

Treatment involves washing the corms thoroughly with a water spray, followed by dipping, preferably in a muslin or cheese cloth bag as summarised in Table 1. If mercuric chloride is used, a wooden, glazed-earthenware, glass, or other non-corrosible container, is essential.

After immersion, drain off the dipping solution and spread the corms out on well-ventilated racks to dry. Wire-netting "stretchers" arranged in tiers suitably spaced are satisfactory.

Table 1 sets out the details of the various dipping treatments which may be used to prevent botrytis corm rot in storage.

From an economic point of view, it would be desirable to use the same solution for several batches of corms. However, some loss of strength follows each dipping, and, therefore, the solution can be used for one batch of corms only, unless the strength of the solution is restored. Only limited experimental work has been conducted on this aspect of the problem, and only tentative recommendations are possible at present.

TABLE 1.

Fungicide.	Concentration.	Time of Dipping.
		Minutes.
Mercuric chloride (corrosive sublimate) plus Agral II.	Cor. sublimate, 1 in 1,000; Agral II., 1 in 2,000	2
Hortosan DP ..	2 oz. in 10 gallons	15
Zetan (synonymous with "New Improved Semesan Bel.")	1 lb. in 10 gallons	15
Aretan	4 oz. in 10 gallons	15

Hortosan DP may be restored to approximately its original strength by adding ½ oz. of Hortosan DP after dipping each batch of 500 corms in 10 gallons of the solution for fifteen minutes. This cannot be accurate, since the amount of the active ingredient removed by the corms will vary with the size of the corms, and the amount of soil on them.

According to the manufacturers' directions, Zetan may be used for successive batches of corms until the solution is reduced to two-thirds of its original volume. This point was not checked experimentally in the investigation on this disease.

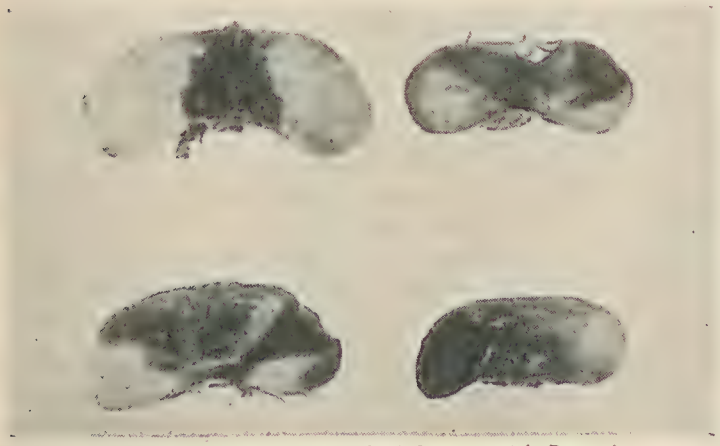

Fig. 4.—Progressive stages in infection with Botrytis.

No tests were conducted on the depletion of the strength of Aretan or corrosive sublimate, by dipping successive batches of corms, and no recommendations can be given for restoring the strength of these materials.

Dehusking and Main Disinfection Treatment

When the old corms and the bases of the leaves and roots are thoroughly dried off, and the skin tissues have become thoroughly "set" and matured, which will normally be about six weeks after digging, the corms should be dehusked, and the old parent corms removed. All debris removed is best destroyed by burning, deep burial or rendered sterile by immersion in strong disinfectants.

When dehusking, all but the husks around the new growing points should be removed, but this should not be carried out too early or large unsightly scars, detrimental to the sales value of the corms, and readily susceptible to fungal infection, will be caused.

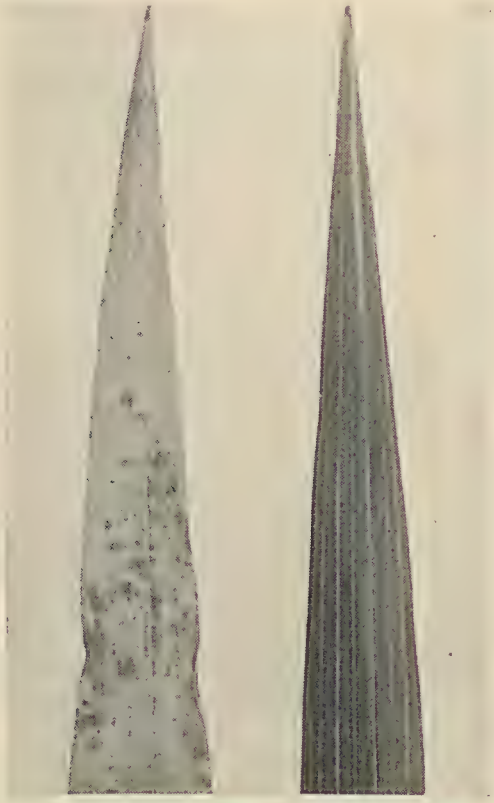

Fig. 6.—Leaves infected with Botrytis. The leaf on the left was unsprayed; the one on right was sprayed with 6 : 4 : 40 Bordeaux mixture.

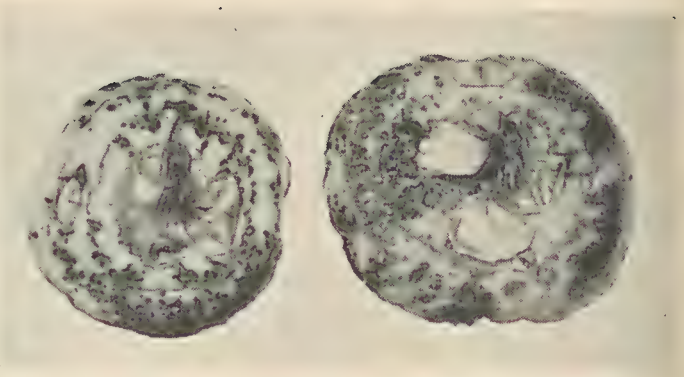

Fig. 7.—Corms affected with Sclerotinia Dry Rot.

Before planting time, all the corms should be carefully picked over and any showing fungal lesions should be removed for destruction or surgical treatment. The remainder of the apparently healthy corms are then subjected to the *main disinfection treatment* in corrosive sublimate 1 : 1,000 for eight to twelve hours, or in the organic mercury treatments, Hortosan DP, Aretan, Zetan, or Mercury E (*Phenyl mercuric acetate*), according to the manufacturers' instructions.

For small batches, calomel (mercurous chloride) may be used, in any kind of container, at the rate of 1 oz. to 1½ pints water, for five to ten minutes, the suspension being kept well stirred during the period. This main disinfection treatment is to destroy the invisible spores of any fungal parasites which may be present, and which, if not destroyed, would introduce the pathogens concerned into the soil at planting time. It is desirable to give the final disinfection before the corms have sprouted.

Corms affected with the craters or pits of bacterial scab can be disinfected, if allowed to remain long enough in the dip. For corrosive sublimate, "1 in 1,000", containing Agral II. at the rate of "1 in 2,000", 12 to 24 hours may be required to give complete disinfection in the case of the larger craters.

The surgical treatment of rare, or highly-prized, corms, is effected by cutting out all diseased tissue, so long as there is some healthy root-forming tissue remaining, and dipping the cut surfaces into slaked lime or flowers of sulphur, or an equal mixture of both. The uninjured surfaces of such corms may be disinfected by wiping over

with methylated spirits several times and allowing to dry by evaporation between each successive application.

Preparation of Mercuric Chloride "1:1000".

Mercuric chloride (corrosive sublimate) 1 : 1,000 is prepared by dissolving 1 oz. of the extremely poisonous powder in a little water containing ¼ oz. table salt, in a non-corrosible container, and then diluting with water in a similar container to 6¼ gallons, or *pro rata*.

Owing to the clear, colourless appearance of this solution, and its complete absence of smell, or taste, in spite of its extremely poisonous properties, great care must be taken in its use, and, when finished with, the solution should be poured into a deep hole in the ground, or otherwise suitably disposed of.

Rotation of Crops

The cleaned and disinfected corms, after again being dried off, should be planted only in new ground, or in soil on which a well-planned system of rotation of crops, avoiding repetitions of gladioli or closely-related plants more frequently than once in every four or five years, if possible, has been carried out.

Spraying the Foliage

When the leaves are through the ground, attacks on the leaves by (a) *Septoria gladioli;* (b) *Botrytis cinerea or* (c) *Botrytis gladioli;* (d) *Sclerotinia gladioli* or (e) *Bacterium marginatum* may be prevented by periodic sprayings with home-made Bordeaux Mixture 4 : 4 : 40 strength plus Agral II., "1 in 2,000," or else containing ½ gallon prepared white spraying oil to every 40 gallons of spray. These sprayings are particularly valuable in the early part of the growing period, and again immediately after flowering, and, if applied at fortnightly intervals before the first flowers on the flower spikes open, and then later, as indicated, little, if any, damage, from leaf-attacking fungi, or flower-spotting from attacks of *Botrytis spp.*, need be feared under normal climatic conditions.

After flowering, spraying with 6 : 4 : 40 home-made Bordeaux Mixture plus Agral II., 1 : 2,000, may be used, in localities where *Botrytis* is known to be serious, or in seasons with very moist autumn weather. The correct strength of Agral II., (1 in 2000), is given by dissolving one half-ounce of the powder in six and one-quarter gallons of the prepared Bordeaux mixture, mercuric chloride solution, etc., as the case requires.

Unwanted flowers or faded flowers should not be left in the field, but should be cut and destroyed as for debris as indicated above.

Date of Digging

Early digging is very important in avoiding the ravages of any fungal or bacterial disease of gladioli, as, normally, infection of the new corm does not take place, or, at any rate, does not proceed very far, until towards the end of the growing period. Corm rots destroy tissue *which has already been formed*, not *while it is being formed.* Generally speaking, the plants should be lifted when the foliage commences to show signs of yellowing, i.e., about four to six weeks after flowering. To leave the corms in the ground later than this, or year after year, is to invite trouble, particularly if any form of *overfeeding* of the plants is indulged in. If the corms are dug early, and are lifted in dry weather, pre-storage dipping to avoid Botrytis rot should not be necessary.

PLANT BUGS AND LEAFHOPPERS

Plant bugs and leafhoppers are common pests of household gardens and commercial crops in Victoria. They are related insects and both groups cause damage in the same manner by piercing the soft tissues of plants with their mouth parts and sucking the sap. Leafhoppers may also transmit certain virus diseases.

Three species of plant bugs are of economic importance in Victoria. They are the Harlequin bug (*Dindymus versicolor*), the Green Vegetable bug (*Nezara viridula*), and the Rutherglen bug (*Nysius vinitor*). The leafhoppers include a number of closely-related species.

The Harlequin bug

The adult Harlequin bug is an active insect about ⅝th inch in length. It is conspicuously marked on the upper side of the body with symmetrical patches of orange and black. The under side of the body is predominantly green. The very young insects are brilliantly coloured, with shining red abdomens and black heads. In the intervening stages the colour patterns change until the adult stage is reached.

This insect occurs sporadically in large numbers, causing considerable annoyance and sometimes appreciable damage. It thrives in undisturbed locations amongst weeds and rubbish in which the insects shelter and breed. It overwinters in both the adult and immature stages in sheltered positions such as cavities under the bark of trees, in fences between palings and rails, and other similar hiding places.

During spring and summer, the insects mate and crawl over various types of plants sucking the sap from foliage, flowers, and fruits. When they are numerous, the insects may cluster in large masses on infected plants.

The eggs are laid in early summer on the soil in sheltered situations frequently at the bases of fences or buildings.

CONTROL

(1) Keep down weeds and grass, particularly against fences and walls.

(2) Do not leave heaps of rubbish, garden refuse, prunings, timber stacks, and similar hiding places neglected for long periods.

(3) If the insects are migrating from adjacent land, spray the bottoms of fences with creosote oil. Spray between the rails and palings to prevent the bugs harbouring between them.

(4) Spray infested plants with 0·2 per cent. DDT horticultural emulsion. If the bugs are numerous, it may be necessary to repeat the spray after an interval of one week.

The Green Vegetable bug

The Green Vegetable bug is about $\frac{1}{2}$ inch long in the adult form, stoutly built, and of a fairly uniform grass-green colour. Newly-hatched insects are orange and black. As they grow, the colour changes—black, white, red, and green appearing in varying proportions until the adult green stage is reached.

Green vegetable bugs first appeared in the northern areas of Victoria in 1936, and have spread steadily ever since. They attack a wide range of plants, including both fruit and vegetables.

The female bugs overwinter under the bark of trees and in other suitable hiding places. They become active in November, laying their eggs on the under sides of leaves. The eggs, which are creamy-white in colour, are usually laid in neatly-arranged batches. The number of eggs in each batch varies from 30 to 80. Both the leaves and fruit of tomatoes and beans are particularly susceptible to injury from this insect.

CONTROL

The green vegetable bug is a difficult insect to control. For general purposes spray affected plants with 0·2 per cent. DDT horticultural emulsion or dust with 2 per cent. DDT dust. It is unwise to apply these materials to crops such as tomatoes and beans which are ready for picking. For such crops there are indications that spraying with hexaethyltetraphosphate (HETP), 1 oz. in 10 gallons of water will give good control.

The Rutherglen bug

The adult Rutherglen bug is an inconspicuous insect about $\frac{3}{16}$th inch in length, greyish-brown in colour with transparent wings. The young forms, which are usually found on the ground, have oval reddish-brown wingless bodies. They appear in the spring and several generations may occur during one season.

The Rutherglen bug can usually be found in small numbers during the summer months in almost any locality. The eggs are laid on low herbaceous plants found on roadsides, pastures, and headlands which are the principal breeding grounds.

In certain years, they develop in these situations in enormous numbers over wide areas, and both the winged and immature forms then migrate in plague proportions to commercial crops and home gardens where they cause serious damage. Fruit, flowers, and leaves may suffer injury from the feeding of the insects. During severe infestations the insects may cluster on infested plants in dark masses.

CONTROL

When Rutherglen bugs are observed in larger numbers than usual early in the season, it is advisable to examine headlands and other waste areas for the presence of immature forms. When these are present in sufficient numbers to cause concern, steps should be taken to prepare against a plague later in the season. In view of the wide distribution and powers of flight of the insect, community action is essential.

(continued on page 134).

THE VEGETABLE GARDEN

By GEORGE HYAM, Horticultural Supervisor.

SOWING ONION SEED

ONION seedlings are easy to raise and, to ensure that you obtain the variety suitable for the season, it is best to raise your own.

The early varieties, Flat White, White Queen, and Silverskin, can still be sown and Early Globes are sown at the end of March. The quality and size of the bulbs depend to some degree on the way the seedlings are raised and the rejection of weedy-looking plants when planting out.

There is ample seed in the average retail packet to allow for a rigorous culling of plants for the home garden. Sow on a raised bed 6 inches above ground level or in a seed box of that depth filled with light soil, first lightly dusting the surface with superphosphate and raking this in. Sow in drills spaced 3 inches apart as thinly as possible covering the seed with ½ inch of soil and then mulching with a thin layer of rotted manure or compost.

Onion seedlings suffer damage if allowed to become dry. Therefore, during the remaining warm weather, make sure that the seed-bed is watered frequently. At the same time, do not allow the bed to become water-logged as this is the main cause of mildew and other rots. Thinning out to at least 1 inch apart should start at the earliest possible stage so that the plants develop sturdy stems and plenty of root.

Although onion seedlings can be planted out when quite advanced, it seems that planting out when in the two or three-leaved stage, about 6 to 8 inches high and without trimming, gives better results for most kinds in the home garden. In order to avoid too thick a sowing in the seed bed, a sprinkling of some white powder such as flour, lime, or chalk spread along the bottom of the drill will clearly show the black seeds sown along it. About 50 seeds to the foot should be the aim.

HINTS ON CAULIFLOWER GROWING

Some gardeners find cauliflowers one of the most difficult crops to grow satisfactorily. However, if the peculiarities of this vegetable are known, it is no more difficult to raise than the other brassica leaf crops.

Choosing the proper variety for the season is important, and the climate of the district also has an influence on growth. It is risky to plant unnamed cauliflower seedlings as these may be the wrong variety for the season. It is far better to raise them from seed and, as the period of use for most of them will not exceed three or four weeks, the home gardener should raise two or three varieties. The time taken to develop from seed to maturity varies, and most good seed catalogues give these periods.

Late February and March is a good time to plant out the seedlings of early varieties such as Early Green Glazed (or Early Greenleaf) or Early Eclipse. The Green Glazed variety is specially suitable in the warm dry areas, as its foliage stands heat well. These will mature in four or five months after sowing, or, say, three months from planting.

March is also a good time to sow the seeds of the Phenomenal strains which, being of Mediterranean origin, stand our conditions better than those raised in northern Europe. Early Phenomenal matures in four months, and Maincrop Phenomenal in six months, and both can be sown at the same time, but it is now rather late to sow the early kind in warm districts. Seed of Metropole, maturing in eight months, and Autumn Giant, maturing in six months, can be sown now.

There are also some good local selections sold under the names of the month in which they reach maturity, and these are now the most largely grown strains in the metropolitan market gardens. Seeds of these are hard to buy in retail packets, but raisers specializing in market gardeners' seedlings can usually supply seedlings of these varieties. It is often found that a certain

Leaf crops should be dusted throughout their growing period. A small hand duster saves material.

variety stands out as the best for the district, and it is advisable to consult any local grower who consistently grows good cauliflowers, or to experiment a little with various varieties.

Apart from planting the right strain it is equally important to realize that cauliflowers need a very rich soil and adequate watering to prevent any check in growth. The ground should have had at least a bucketful of stable manure or compost dug into each square yard a month or so before planting out, and this should be supplemented by 2 oz. of superphosphate per square yard raked in before planting.

During growth, the plants will need side-dressings of sulphate of ammonia applied about every six weeks. More details of this treatment will be given at the appropriate time. Some seedlings develop only two leaves without a visible growing tip in the centre. These are known as " blinds " and they will never make a heart and should not be planted.

Dusting with DDT and nicotine or " Gammexane " should start as soon as the plants become established, as one insect can destroy the growing tip of a young plant.

SUPPORTS FOR BROAD BEANS

It appears difficult to obtain the true strain of Dwarf Prolific broad bean at present, but, in small gardens, broad beans of any height can be kept in bounds, and tall varieties like Leviathan and Broad Windsor generally crop better. Horizontal strings or rods attached to stakes placed on each side of the row, and about 12 inches away from it, will prevent the maturing beans from falling over even in heavy wind. When the first shoots are about 12 inches high, the tips should be nipped out to make the plants stool; later on, side shoots are likewise stopped when about 3 feet high. This has the effect of stiffening the stems and making the pods set well towards the base.

March is the best time to sow broad beans and this sowing is less affected with aphis than when sown earlier or later. Dusting the seed with a special legume dust cuts down the incidence of rust and leaf-spot considerably. The soil should be limed and a good fertilizer used. For broad beans apply a mixture consisting of 3 parts of superphosphate to 1 of potash, adding 1 part of sulphate of ammonia on sandy soils that have not been manured recently. The ready-mixed 5 : 1 : 1 fertilizers are a good alternative. Use about 2 oz. per yard of row, placing it at each side of the seeds, 3 inches deep and 2 inches away from the row.

OTHER MARCH WORK

As French bean crops finish, prepare the beds for planting leaf crops by digging in some organic manure. Onions can follow beans or sweet corn without further manuring. Pull up any exhausted or diseased tomato plants, burning any that show signs of disease. Leaf crops can follow tomatoes with a little extra manuring, but broad beans would be better.

Picking some of the mature pumpkins or squash will allow the plants to grow on through this month. Keep the soil heaped up towards root crops when cultivating between the rows. Cultivate lightly round young cauliflowers and Brussels sprouts, and, when these are about six to eight weeks old, cultivation should cease within the spread of their leaves. Cabbages can be cultivated closer and they benefit by being hilled up. Brussels sprouts can still be planted out, but it is too late to sow the seeds for a reasonable yield. They finish producing in early September even if planted late.

THE FLOWER GARDEN

ALTHOUGH the removal of the dead flowers from plants is time absorbing, the operation is well repaid because it means a longer flowering season. Most plants when they have set seed receive a check to their growth and this is thought to be due to the formation of hormones within the plant tissue. If the fading flowers are removed sufficiently early, this hormone production is checked, and better quality flowers in larger quantities are obtained. The energy which the plant would normally expend on maturing seed is diverted to new growth and flower production. This is particularly noticeable in dahlias.

On the other hand, if it is desired to obtain seed, it is a better practice to retain the mid-season flowers than to delay until the end of the season. Dahlias, zinnias, and other composites frequently produce mouldy seed-heads late in the season, and the vitality of the seeds is affected. The seed-heads produced during the earlier part of the season are better nourished and may be harvested and dried without the incidence of mould.

On a plant like the dahlia it is only necessary to obtain several seed-heads in order to retain quite a number of seeds, and consequently all the superfluous seed-heads can be removed. Raising dahlias from seed is a fascinating occupation, and the results are always sufficiently interesting to encourage the home gardener to continue from year to year in the hope of raising an outstanding new variety.

MILDEW

The mild weather conditions which are experienced this month, together with the dews at night, favour the development of mildew on many garden plants. There are many forms of mildew, but essentially they are fungous diseases which live on the surface of the leaf and obtain nourishment from the leaf, at the same time causing a smothering effect due to the strands of the fungus spreading over the leaf surface.

Roses and delphiniums are particularly susceptible to mildew infection. As soon as the first signs of the condition, which takes the form of a dust-like powder over the leaves, are seen, dust the plants with flowers of sulphur, which can be obtained from the grocer, or spray with a spray mixture containing sulphur. Dusting is best done on a bright sunny day. The warm temperatures assist in the control of the disease because the sulphur is readily changed into gas.

GLADIOLI

Gladioli corms should be lifted about six weeks after flowering. It is not advisable to leave the corms in the ground from season to season. If this is done, a large number may be lost by rot.

After lifting the plants, the tops may be cut off about 6 inches above the corms. They should then be dipped in a DDT spraying solution to prevent any carryover of aphis or thrips. Then the corms should be stored in a cool, airy shed to dry. Remove foliage when dry and brittle. The corms should then be dipped according to the method described in an article dealing with corm-rot diseases of gladioli appearing on page 125 of this issue.

THE WAX PLANT

The wax plant is a very attractive climber, and is sometimes called the Climbing Wax Flower. Its botanical name is *Hoya carnosa* and it is a native of Eastern Asia and Northern Australia.

It has thick, dark, glossy, green leaves and is quite a vigorous-growing plant if given the right situation and soil conditions. The young growth is of a bronze colour and is very tender. The pink, wheel-shaped flowers are borne in clusters in the axils of the leaves during summer. These flowers are produced on club-like spurs, and it is necessary that the spur should be retained on the plant because it will bear flowers again next season. If the spur is removed no more flowers will be produced at this point.

One of the best positions for this plant is under the eaves of a house on a wall facing the east, or under a light verandah, either growing in the garden bed or in pots or tubs. In Victoria, the plant requires shelter from the very hot sun of summer and also from frost in winter.

The soil should be a medium to a heavy loam and contain plenty of old leaf-mould and some limestone rubble. During the winter the soil should be kept fairly dry because then the plant is resting, but, in spring and early summer, watering should commence if the situation is dry, and weak liquid manure can be applied at intervals of two or three weeks.

The plant is not difficult to propagate as it strikes rather readily from cuttings taken in the spring, or it can be layered.

BIOLOGICAL NOTES—*(continued from page 130).*

Where practicable, and particularly in small holdings such as vegetable gardens, areas heavily infested with immature forms should be sprayed with 0·1 per cent. DDT horticultural emulsion at a rate of at least 100 gallons to the acre.

If swarms of winged insects appear later, infested crops should be sprayed with 0·1 per cent. DDT horticultural emulsion. This will provide protection for about two weeks, and further spraying may be necessary during a severe plague.

Leafhoppers

Leafhoppers (jassids) are commonly found during the summer months infesting a wide range of plants. They are small insects and frequently yellowish in colour. This colouration has given rise to the rather unsuitable name, "canary fly". These insects are rather inconspicuous and may pass unnoticed, even when they are present on plants in large numbers until they are disturbed, when they rise rapidly into the air.

Individually, jassids cause very little damage, but, when present in large numbers, their combined effect may be very harmful. Not only is the sap sucked from the leaves, but certain virus diseases may be transmitted from plant to plant.

If the presence of leafhoppers is suspected, the plant should be examined without disturbance. Leafhoppers may then be observed as small insects yellow to brown in colour, about $\frac{1}{8}$th inch in length, blunt at the head and tapering to the tail.

Control

The leafhopper may be controlled by dusting affected plants with a 2 per cent. DDT dust or spraying with 0·1 per cent. DDT horticultural emulsion. More than one treatment may be necessary to cope with insects migrating on to plants from an outside source.

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BUTTER FACTORY OVERRUN IN VICTORIA

By D. A. LANCASTER, A.F.I.A., L.A.A., Inspecting Officer

OVERRUN can be defined as the amount of commercial butter made in excess of the quantity of butterfat received. In actual butter-factory practice it is the difference between the amount of butterfat purchased and paid for, and the amount of butter sold. This is what is referred to on the account sales rendered to suppliers, the overrun being expressed as a percentage, the calculation of which will be referred to under the heading, "Calculation of Overrun."

MAXIMUM OVERRUN

The maximum overrun allowed in Victoria under the Dairy Produce Regulations is 22 per cent., calculated on the actual weight of butter manufactured, with a reduction of 1·5 per cent. in respect of the proportion of unsalted butter made each month. The quantity of unsalted butter must be recorded by the owner of a factory in the prescribed manner.

The butterfat in any milk or cream, used for purposes other than butter making must be estimated by weighing and testing, and the amount deducted from the total weight of butterfat received. In the case of factories receiving milk, the loss in separating is taken into consideration and allowed for in estimating the overrun.

CALCULATION OF OVERRUN

The actual butter-factory overrun is calculated by deducting the total weight of butterfat paid for from the total weight of butter made. The per cent. overrun is calculated by multiplying the pounds overrun by 100 and dividing by the pounds of fat received.

Butter — fat = lb. overrun.

Lb. overrun × 100 ÷ fat = per cent. overrun.

From this we evolve the following simple formula to find per cent. overrun.

$$\frac{b - f}{f} \times 100 = \text{per cent. overrun}$$

b and f designating butter and butterfat respectively; e.g., 1,000 lb. of butterfat produces 1,220 lb. of butter, what is the percentage of overrun?

$$\frac{1{,}220 - 1{,}000}{1{,}000} \times 100 = 22 \text{ per cent. overrun.}$$

CALCULATION OF OVERRUN FOR UNSALTED BUTTER

The maximum overrun allowed is 22 per cent. for a salted butter, and 20·5 per cent. for an unsalted butter. The percentage of overrun can be calculated by applying the above formula, but a difficulty arises when the total manufacture consists partly of salted and partly unsalted butter. The question then arises—what is the maximum overrun allowed? A moment's reflection will reveal that it is not 22 per cent. or 20·5 per cent., but some percentage lying between these two limits. How is this percentage to be ascertained? The first step is to ascertain the proportion of unsalted butter to the total manufacture, then that fraction of 1·5 per cent. is calculated; the resulting percentage is then deducted from 22 per cent., and the remainder will represent the maximum overrun allowed, e.g., a factory manufactured 20,000 lb. of butter, 5,000 lb. of which was unsalted. What would be the maximum overrun allowed by the Regulations?

$$22 - \left(\frac{5{,}000}{20{,}000} \text{ of } 1{\cdot}5\right) = 21{\cdot}625 \text{ per cent.}$$

Maximum overrun allowed = 21·625 per cent

CALCULATION TO INCLUDE LOSS IN SKIMMING

In the case of factories receiving milk, it is necessary to take into consideration the loss of fat in separating and to allow for this loss when calculating the overrun. This loss of fat has been fixed by regulation,

for the purpose of calculating overrun, at 0·07 per cent. The pounds of fat lost in the skim milk must be deducted from the quantity of fat contained in the whole milk purchased from suppliers. The resulting amount of butterfat (which will be less than the amount paid for) will be the figure from which the calculation of permissible manufacture will be made, e.g., a factory receives and separates the following quantity of milk :—

100,000 lb. of 4 per cent. milk.

36 per cent. cream is separated.

Skim milk tests 0·07 per cent. fat.

(*a*) What amount of fat is lost ?

(*b*) What amount of fat is left for manufacturing into butter ?

(*c*) What is the permissible manufacture ?

(*d*) What is the permissible overrun ?

Butterfat contained in milk =

$$\frac{100{,}000 \times 4}{100} = 4{,}000 \text{ lb. fat.}$$

Lb. of skim milk =

$$\frac{100{,}000 \times (36-4)}{(36-0{\cdot}07)} = 89{,}062 \text{ lb. skim milk (approx.)}$$

Fat lost in skim milk =

$$\frac{89{,}062 \times 0{\cdot}07}{100} = 62{\cdot}3 \text{ lb. fat.}$$

Fat for butter making =

$$4{,}000 - 62{\cdot}3 = 3{,}938 \text{ lb. fat (approx.).}$$

Permissible manufacture =

$$\frac{3{,}938 \times 122}{100} = 4{,}804{\cdot}4 \text{ lb. butter.}$$

Lb. of overrun =

$$4{,}804{\cdot}4 - 4{,}000 = 804{\cdot}4 \text{ lb. butter.}$$

Permissible overrun =

$$\frac{804{\cdot}4 \times 100}{4{,}000} = 20{\cdot}1 \text{ per cent.}$$

When a factory receiving and separating milk disposes of all the skim milk, and receives payment for the butterfat content of the skim milk, it is not necessary to allow a separating loss when calculating overrun. The butterfat lost in skimming constitutes the fat content of the skim milk sold and is treated as a sale of butterfat ex milk. Therefore, under these conditions, it is possible for a factory which receives and separates milk to obtain a 22 per cent. overrun.

Butterfat purchased ex milk ..	4,000 lb.
Butterfat sold ex milk ..	62 lb.
Net butterfat purchased for butter-making	3,938 lb.
Permissible manufacture ..	4,804 lb.
Permissible per cent. overrun ..	22·0%

CALCULATION OF OVERRUN FROM FARM AND FACTORY CREAM

A further aspect must now be considered—a factory may receive a portion of its supply ex milk, and the balance ex cream. A moment's reflection will reveal that the overrun allowed must be a percentage less than 22 per cent., but higher than the percentage of overrun allowed when the total fat for butter making is derived exclusively from factory separated cream. Taking the foregoing figures we now suppose that in addition 1,062 lb. of fat were received ex supplier cream. The position would now be as follows :—

Fat ex milk	3,938 lb.
Fat ex supplier cream ..	1,062 lb.
Fat for butter making ..	5,000 lb.
Skimming loss	62 lb.
Total fat purchased ..	5,062 lb.

The question now arises—what will be the maximum overrun allowed by the Regulations ?

The following formula is recommended for use by operatives working under actual factory conditions. Actually, in such cases, per cent. overrun has little significance, it is the permissible manufacture which is of paramount importance.

Butterfat purchased ex milk ..	4,000 lb.
Butterfat ex supplier cream ..	1,062 lb.
Butterfat purchased for butter making	5,062 lb.
Deduct skimming loss ..	62 lb.
Butterfat available for butter making	5,000 lb.
Permissible manufacture ..	6,100 lb.

$$\frac{5{,}000}{1} \times \frac{122}{100} = 6{,}100 \text{ lb.}$$

Permissible lb. overrun .. .. 1,038 lb.

Permissible per cent. overrun 20·5 per cent.

$$\frac{(6{,}100 - 5{,}062) \times 100}{5{,}062} = 20{\cdot}5 \text{ per cent.}$$

CALCULATION OF OVERRUN WHEN SALTED AND UNSALTED BUTTERS ARE MANUFACTURED

It has already been explained that the maximum overrun allowed for an unsalted butter is 20·5 per cent. This fact further complicates the position if our hypothetical factory decides to manufacture both salted and unsalted butters. It is clear that the maximum overrun will be still further reduced depending, of course, on the percentage of unsalted butter manufactured. Taking the foregoing figures we now assume the position to be as follows :—

Butterfat ex milk	3,938 lb.
Butterfat ex supplier cream ..	1,062 lb.
Butterfat available for butter making	5,000 lb.
Add skimming loss	62 lb.
Butterfat purchased for butter making	5,062 lb.

Assuming the manager instructs the butter maker to make 1 ton (2,240 lb.) of unsalted butter and the balance salted. The question now arises—what will be the maximum overrun allowed by the Regulations ?

It has been explained that a reduction of overrun must be allowed in respect of butter manufactured from the cream received ex milk. But we must now go a step further and take cognizance of the fact that a portion of the butter manufactured (2,240 lb.) is unsalted, and that the overrun will be further reduced by 1·5 per cent. in respect of that portion. A moment's consideration will reveal the fact, that if all butter were unsalted the maximum overrun would be 19 per cent. (20·5—1·5). Therefore, the maximum must be some percentage less than 20·5, but greater than 19 per cent. The fat for butter making, in respect of the unsalted butter manufactured, must first be ascertained. The second step will be to calculate the percentage of the total fat available for butter making that has been diverted to the manufacture of unsalted butter. This percentage of 1·5 is then deducted from 20·5 per cent.—the remainder will then represent the permissible overrun.

Fat for butter making (unsalted) =

$$\frac{2,240}{1} \times \frac{100}{119} = 1,882 \text{ lb. fat (approx.).}$$

Permissible overrun =

$$20·5 - \left(\frac{1,882}{5,062} \text{ of } 1·5\right) = 19·94 \text{ per cent.}$$

When working overruns, under actual factory conditions, the calculation of the amount of skim-milk is simplified (in Victoria) by taking 88 per cent. of the total milk purchased from suppliers to represent skim-milk. Taking the 100,000 lb. of milk supplied to our hypothetical factory, and applying this rule, 88,000 lb. would represent skim-milk. The skimming loss would thus be 61·6 lb. of fat, or 0·7 lb. less than by the method adopted above. This example demonstrates that the difference between the two methods is very slight, and justifies the adoption of the simplified method of calculation.

To make the matter clear we will take a practical problem. A factory receives the following amounts of milk and cream :—

100,000 lb. of milk containing	4,000 lb. fat
2,655 lb. of cream containing	1,062 lb. fat
Amount of fat paid for ..	5,062 lb. fat

The total manufacture is 6,500 lb. of butter, 2,240 lb. of which is unsalted. What is the permissible manufacture ?

Lb. of skim milk =

88 per cent. of 100,000 = 88,000 lb.

Fat lost in skim milk =

$$\frac{88,000 \times 0·07}{100} = 61·6 \text{ lb. fat.}$$

Fat for butter making = 5,062 — 61·6 = 5,000 lb. (approx.)

Permissible manufacture (if salted) =

$$\frac{5,000 \times 122}{100} = 6,100 \text{ lb. butter.}$$

Pounds of overrun =

6,100 — 5,062 = 1,038 lb. butter.

Permissible overrun (if salted) =

1,038 × 100 ÷ 5,062 = 20·5 per cent.

Percentage overrun for unsalted portion =

20·5 — 1·5 = 19 per cent.

Fat for butter making (unsalted) =

$$\frac{2,240}{1} \times \frac{100}{119} = 1,882 \text{ lb. fat (approx.).}$$

Final permissible overrun =

$$20 \cdot 5 - \left(\frac{1,882}{5,062} \text{ of } 1 \cdot 5\right) = 19 \cdot 94 \text{ per cent.}$$

Permissible manufacture =

$$\frac{5,062 \times 119 \cdot 94}{100} = 6,071 \text{ lb. (approx.).}$$

Excess overrun =

$$6,500 - 6,071 = 429 \text{ lb. butter.}$$

EFFECT OF CREAM SALES ON OVERRUN

When portion of the intake of a factory receiving and separating milk, is sold as cream, and the balance used for butter making, it is sometimes contended that it is quite unnecessary to apportion the skimming loss between cream sales and butter manufacture. If the skimming loss is not apportioned it will not affect the permissible manufacture—this will be the same in either case—but it will affect the per cent. overrun and the financial result of the transactions. To arrive at the true net profit of the various departments of a factory, it is essential that an apportionment of the skimming loss be made. Only by making such an apportionment can each section be charged with the correct amount of butterfat purchased for purposes of processing, and thus enable the true net profit for each department to be ascertained for costing purposes. For example, taking the following figures, the first method illustrated would result in the butter manufacture being debited with 14,849 lb. of butterfat, and the cream sales department 26,081 lb. of butterfat. When an apportionment of the total skimming loss is made, as in the second example, the butter manufacture department is debited with 14,526 lb. of butterfat, and the cream sales department with 26,404 lb. of butterfat. It is quite clear, therefore, that if this apportionment is not made, as is sometimes the case, cream sales will show a fictitious profit.

Example No. 1 (Skimming Loss not Apportioned).

	lb.
Total butterfat purchased ex milk	40,930
Deduct cream sales :—	lb.
Creamery A	7,191
B	4,519
C	7,978
D	3,362
E	3,509
	26,559
Less cream returns :—	lb.
Creamery A	34
B	444
	478
Net cream sales	26,081
	14,849
Add cream b/f	106
	14,955
Deduct cream c/f	225
	14,730
Add farm-separated cream	8,259
Net butterfat purchased for butter making	22,989
Deduct skimming loss	500
Butterfat available for buttermaking	22,489
Butter manufactured	27,162
Pounds of overrun	4,173
Per cent. overrun	18·11

$$\frac{(27,162 - 22,989) \times 100}{22,989} = 18 \cdot 11.$$

Permissible manufacture = 27,436·6 lb. butter.

$$\frac{22,489}{1} \times \frac{122}{100} = 27,436 \cdot 6 \text{ lb.}$$

Permissible percentage overrun = 19·3.

$$\frac{(27,436 \cdot 6 - 22,989) \times 100}{22,989} = 19 \cdot 3.$$

Note.—Skimming loss not being apportioned, per cent. overrun is incorrect. However, the above form of calculation is useful as a simple method of arriving at the permissible manufacture for purposes of overrun control under manufacturing conditions.

Example No. 2 (Skimming Loss Apportioned).

	lb.
Total butterfat purchased ex milk	40,930
Deduct cream sales :—	lb.
Creamery A	7,191
B	4,519
C	7,978
D	3,362
E	3,509
	26,559

Less cream returns :—		
	lb.	
Creamery A ..	34	
B ..	444	
	478	
Net cream sales ..	26,081	
Plus share of skimming loss ..	323	
		26,404
Butterfat ex milk purchased for butter making		14,526
Add cream b/f		106
		14,632
Deduct cream c/f		225
		14,407
Add Farm separated cream ..		8,259
Net butterfat purchased for butter making (O.R.)		22,666
Less net skimming loss ..		177
Butterfat available for butter making ..		22,489
Butter manufactured		27,162
Pounds of overrun		4,496
Per cent. overrun		19·8

Permissible manufacture = 27,436·6 lb. butter.

$$\frac{22,489}{1} \times \frac{122}{100} = 27,436{\cdot}6 \text{ lb.}$$

Permissible lb. overrun = 4,770·6.

Permissible percentage overrun = 21·05.

$$\frac{(27,436{\cdot}6 - 22,666) \times 100}{22,666} = 21{\cdot}05.$$

Apportionment of skimming loss :—

	lb.	lb. fat
Intake ex milk ..		40,930
Disposals—		
Sold ex cream ..	26,081	
Used for butter ..	14,349	
	40,430	
Lost in skimming ..	500	
		40,930

Apportionment of skimming loss :—

Borne by butter manufacture—

$$\frac{14,349}{40,430} \times \frac{500}{1} = 177$$

Borne by cream sales—

$$\frac{26,081}{40,430} \times \frac{500}{1} = 323$$

Total skimming loss	500

Butter manufacturing department debited with ..	lb.	14,349
		177
		14,526
Cream sales department debited with		26,081
		323
		26,404
Total intake ex milk ..		40,930

The necessity for apportionment of the skimming loss, as stated earlier, is often disregarded, the contention being that the permissible manufacture will be the same in either case. It is true that, when dealing with the question of overrun as affecting factories receiving and separating whole milk, it is necessary to think in terms of permissible manufacture rather than in terms of per cent. overrun. But immediately cream sales take place another factor arises and apportionment becomes necessary. To illustrate the necessity for apportionment the following example is given. It will be noticed that an extreme case is taken for purposes of illustration, because the result so convincingly demonstrates the necessity for apportionment of the skimming loss.

Example No. 3A (Skimming Loss not Apportioned).

		lb.
Total butterfat purchased ex milk ..		40,000
Deduct cream sales		39,000
Butterfat purchased for butter making ..		1,000
Deduct skimming loss ..		500
Butterfat available for butter making		500
Butter manufactured		610
Pounds overrun		—390
Per cent. overrun		Nil

Example No. 3B (Skimming Loss Apportioned).

		lb.
Total butterfat purchased ex milk ..		40,000
Disposals—	lb.	
Sold ex cream ..	39,000	
Used for butter ..	500	
	39,500	
Lost in Skimming ..	500	
		40,000

Skimming loss apportioned :—

Borne by butter manufacture—

$$\frac{500}{39{,}500} \times \frac{500}{1} = 7$$

Borne by cream sales—

$$\frac{39{,}000}{39{,}500} \times \frac{500}{1} = 493$$

500

	lb.
Total butterfat purchased ex milk ..	40,000
Deduct—	
Cream sales	39,000
Add share of skimming loss	493
	39,493
Butterfat purchased for butter making (O.R.)	507
Less net skimming loss ..	7
Butterfat available for butter making	500
Butter manufactured	610
Pounds overrun	103
Per cent. overrun	20·3

DISPOSAL OF EXCESS OVERRUN

The Dairy Produce Act lays down certain conditions relating to the disposal of excess overrun. These conditions may be summarized as follows :—

(1) Within thirty days after the last day of such period during which the prescribed maximum overrun is exceeded, the value of the excess overrun must be distributed *pro rata* amongst the suppliers concerned.

(2) When the excess overrun is less than one-half per centum the value of the excess shall be paid quarterly to the credit of the Pure Bred Bull Fund in the control of the Department of Agriculture.

INFORMATION TO BE FURNISHED TO SUPPLIERS

(*a*) The owner of a factory is required by the Dairy Produce Act, on or before the fifteenth day of each month, to conspicuously display in the factory, for a period of fourteen days, a statement showing :—

(1) The total number of pounds of butterfat received for butter making at such factory.

(2) The number of pounds of commercial butter manufactured from such butterfat.

(3) The percentage of overrun in respect of such manufacture during the preceding month.

(*b*) The owner of a factory must cause the percentage of overrun in respect of such manufacture during such month to be shown in the first account sales, which are rendered to every supplier to the factory, after the display of the above statement.

COMPOSITION OF BUTTER

Regulation 37, Health Acts Regulations, Victoria, prescribes certain limits to which the composition of butter must conform. Thus it would be legal to manufacture a butter for local sale containing 80 per cent. fat, 16 per cent. moisture, and 4 per cent. salt. Such a butter would contain the minimum fat, and the maximum salt and moisture. In addition butter will usually contain about 0·8 to 0·9 per cent. curd. This leads to the consideration of the theoretical overrun which could be attained if all losses and gains, during the process of manufacture, were eliminated, and if exactly 80 per cent. of fat were incorporated in the butter. Under such conditions 80 lb. of butterfat would make 100 lb. of butter, and the overrun would be 25 per cent.

$$\frac{(100 - 80) \times 100}{80} = 25 \text{ per cent.}$$

Unfortunately losses in manufacture are unavoidable, and a butter with such a high salt content would be unsaleable. It is therefore impossible to attain this theoretical overrun of 25 per cent. if all butterfat received is paid for. Correct composition, and the reduction of losses during the process of manufacture to a minimum, is of paramount importance, by this means only can the maximum overrun be legitimately attained. Supposing a butter of the following composition is manufactured :—

Fat	82·0 per cent.
Moisture	15·8 per cent.
Salt	1·3 per cent.
Curd	0·9 per cent.
	100·0 per cent.

If all losses and gains were eliminated the overrun would be 21·95 per cent.

$$\frac{(100 - 82) \times 100}{82} = 21{\cdot}95 \text{ per cent.}$$

If, however, the buttermaker does not strive to attain the maximum yield, and through lack of attention to composition manufactures a butter containing a high percentage of fat, the effect on the factory overrun will be disastrous. The manufacture of a butter containing 83 per cent. fat (eliminating all losses and gains) will result in an overrun of only 20·48 per cent.

$$\frac{(100 - 83) \times 100}{83} = 20{\cdot}48 \text{ per cent.}$$

When an analysis of a factory's butter reveals faulty composition, but at the same time the maximum permissible overrun is being attained, it means that butterfat is being received which is not paid for. This may occur in two ways, under-reading of tests, or short-weighing of cream. To illustrate the effect that the under-reading of tests has on overrun the following table has been compiled. For purposes of illustration calculations have been made on a basis of a 40 per cent. cream.

Cream.	Actual Test.	Recorded Test.	Fat Delivered.	Fat Paid For.	Butter Made.	Overrun.
lb.	%	%	lb.	lb.	lb.	%
250	40	40	100	100·0	122	22·0
250	40	39	100	97·5	122	25·1

The adoption of a system of control of factory overrun by actual analysis of the butter would disclose the relationship between the book overrun and the actual or composition overrun. This would result in increased efficiency, and the elimination of the inefficient operative. The weakness of the present system, in this State, is that it does not give the efficient manager who strives to obtain the maximum yield any advantage over his less efficient neighbour who does not worry much about butter composition. If both attain the maximum overrun, one will have attained it by attention to butter composition, the other by not paying for all butterfat received. Such a system of control would entail a great deal of work, and might produce unexpected administrative difficulties, because it would be necessary for an analysis to be made of a large number of butter samples each month.

It would, however, be a great advantage to the industry. The following table illustrates the loss to a factory, and incidentally the suppliers, when the average butterfat content of the butter is increased by only 0·5 per cent.

Average Percentage of Fat in Butter.	Percentage of Overrun Assuming no Losses or Gains.	Butterfat Purchased.	Butter Manufactured.
		tons	lb.
A. 82·0 ..	21·95	1,000	2,731,680
B. 82·5 ..	21·21	1,000	2,715,104
Additional manufacture by A ..			16,576

If the average price received for butter throughout the period was 2s. 3d. per pound, factory A would, assuming other things being equal, have received £1,864 16s. more for butter manufactured from 1,000 tons of butterfat than factory B. This means that factory A would have this additional amount to distribute to its suppliers.

LOSSES AND GAINS IN MANUFACTURE

Losses and gains during manufacture are very important; this has been amply demonstrated under the heading "Composition of Butter". Therefore, it is necessary to keep a continuous check on losses, and reduce them to the minimum. Conversely, all legitimate gains should be taken advantage of, because, if exploited to the utmost, they tend to offset the inevitable losses incurred during manufacturing operations. The causes of losses and gains which influence overrun must be understood if they are to be controlled, therefore, it is convenient to summarize them as follows:—

Losses:—

(1) Butterfat lost in skimming.
(2) Milk and cream spilled.
(3) Careless rinsing of cans and vats.
(4) Butter wasted.
(5) Butterfat lost in buttermilk.
(6) Two ounces overweight allowed when packing.
(7) Overweight in excess of two ounces when packing.
(8) Losses in printing.
(9) Incorrect weighing, sampling, and testing.
(10) Faulty butter composition. (Low salt and water content.)

Gains :—

(1) Weights of cream recorded to nearest ½ lb. below.

(2) Weights of cans recorded to nearest ½ lb. above.

(3) Cream tests read to nearest ½ per cent. below.

(4) Good butter composition.

To stress the importance of reducing all losses to a minimum, and taking advantage of all legitimate gains the following table has been compiled.

The table should illustrate the necessity for regular analysis of butter, strict attention to composition, and the reduction of manufacturing losses to a minimum. A factory with a high manufacturing loss, and a high percentage of butterfat in the butter manufactured should have a low overrun. If the overrun is equal to the maximum permitted by the Regulations, it means that butterfat is being received which is not paid for.

References

Dairy Produce Act, Vic.
Dairy Produce Regulations, Vic., 1932.
Health Act Regulations, Vic.
Hunziker, O. F., *The Butter Industry*, 3rd Edition.
Valentine, Geo. M., *Butter Overrun and Factors affecting it under New Zealand Manufacturing Conditions.*

Butterfat in Butter.	Theoretical Percentage of Overrun Assuming Percentage Manufacturing Loss of—								
	0.	0·25.	0·50.	0·75.	1·0.	1·25.	1·50.	1·75.	2·0.
%									
80·00	25·00	24·68	24·37	24·06	23·75	23·43	23·12	22·81	22·50
80·50	24·22	23·91	23·60	23·29	22·98	22·67	22·36	22·04	21·73
81·00	23·45	23·14	22·83	22·53	22·22	21·91	21·60	21·29	20·98
81·50	22·69	22·39	22·08	21·77	21·47	21·16	20·85	20·55	20·42
82·00	21·95	21·64	21·34	21·03	20·73	20·42	20·12	19·81	19·51
82·50	21·21	20·90	20·60	20·30	20·00	19·69	19·39	19·09	18·78
83·00	20·48	20·18	19·67	19·57	19·27	18·97	18·67	18·37	18·07

Book Review

Pregnancy Diagnosis Tests: A Review, by Alfred T. Cowie; Commonwealth Agricultural Bureaux Joint Publication No. 13, 1948, p. 283. Obtainable from technical bookshops or from C.A.B. Liaison Officer, 314 Albert-street, East Melbourne, C.2. Price, 18s. 9d.

This publication is a valuable addition to the reviews of scientific literature. The author has surveyed all the important papers on the diagnosis of pregnancy, with the exception of those concerned with clinical methods in women. The bibliography is very comprehensive and occupies 99 of the 283 pages.

The chapter on clinical methods of pregnancy diagnosis briefly summarises methods available to the veterinarian. The remaining nine chapters deal with hormonal tests and enzymic and other biochemical tests of body fluids, as well as tests based on physiological and immunological phenomena, and on physical investigations of body fluids and tissues. The chief value of the book lies in its completeness as a reference work.

The printing and arrangement are quite adequate for this type of book, and the price, 18s. 9d., for such a complete work, is not high.

Accredited Brucellosis-free Herds (Swine)

The following herds of pigs have been accredited as free of swine brucellosis (contagious abortion of pigs) by the Department of Agriculture.

An accredited brucellosis-free herd of pigs is one in which all animals therein have been subjected to two successive blood tests for brucellosis with negative results at intervals prescribed by the Chief Veterinary Inspector of the Department.

In order to remain accredited, a semi-final or annual re-test (as determined by the Chief Veterinary Inspector) of all animals in the herd shall be conducted. If, at a re-test, any animal fails to give a negative reaction to the test, the herd shall not be declared brucellosis-free again until two tests of the complete herd have been carried out with negative results.

Full particulars of the Accredited Swine Brucellosis-free Herd Scheme and application forms may be obtained from the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

Name.	Address.
Anderson, W. H. and C. H.	"Merrileugh," Inverloch
Baker, J. J.	Bannockburn
Barclay, F.	Tyabb
Barclay, T. H.	Tyabb
Barker, E. F.	Killingsworth
Bell, John T.	Yarra Glen
Betts, V. R.	Craig's Lane, Pomborneit
Bidgood Bros.	Wodonga
Bodey, A. A.	"Bonnyview," Dooen
Bright, George H.	Dumbalk
Bruce, J. E.	"Bimbimbie," Dewhurst
Buller, R. A.	Beaconsfield
Butler, J. H.	Newstead
Cardwell, S. R.	Eskdale
Cash, I. M., and Sons	Jindivick
Castle, L. H.	Clarinda
Chapple, S. T.	Rye
Chard, F. J.	Private Bag, Terang
Chisholm, R. J.	Archie's Creek
Churchill, S. R.	Narre Warren, North
Churchill, Stanley	Woolamai
Coates, R. J. H.	Corangamite
Cockbill, Wm.	Rockbank
Coleman, F. and G.	Toongabbie
Cornell, J.	Wheeler's Hill
Coster, John	Newry
Coulthard, J. J.	"Walamba," Whittlesea
Cox, H. H.	Jacaranda Stud, Leopold
Craig, A. A.	Yeoburn East, via Kerang
Critten, H. S.	Dumbalk
Devine, Herbert	Swan Marsh
Dingwall, A. E.	Maffra
Dookie Agricultural College	Dookie
Doornbusch, J. L.	"Starpark," Nhill
Dougall, J. K.	Hastings
Dowie, Alexander	Mt. Moriac
Doyle, Dr. G.	Arthur's Creek
Duncan, C. B.	Cranbourne
Dunstan, John	Tomahawk Creek
Ellwood, A. H.	Paschendale
English, G. H.	Tongala
Fairchild and Clutterbuck	Tinamba
Foletta, G. G., and Son	"Acheron Park," Buxton
Fraser, A. D. J.	Bamawm
Garry, Thos. E.	Kernot
Gay, Leonard M.	Gormandale
Goding Bros.	Moorooduc
Gravener, S., and Sons	Clayton
Greig, J. F. and I. S.	Gnotuk
Hamblin, A. T., and Sons	Toolleen

Name.	Address.
Harris, Clement C.	"Egerton Villa," Loch
Harris, J. D.	Malden Valley
Harrison, C. T.	"Eastside," Pomborneit
Hawtin, I. E. and F.	"Rossmoyne," Colac
Haywood, Dr. A. R.	Hastings
Haywood, G. T. B.	Cranbourne
Hodgins, A. S.	Tyabb
Howard, Alex	Glenfyne
Jackson, Wm. C.	"Patterdale" Stud, Main Ridge
James, W. E.	Templestowe
Jephson, W. T.	Stacey's Bridge
Kergerm, A. C.	Marshall
Kilby, E. A.	Narre Warren North
Lacey, S. T.	Main Ridge
Longerenong College	Dooen
Mackenzie, A. S.	Upper Beaconsfield
Marriott, F. C.	Bentleigh East
Marshman, A. D.	Archie's Creek
Miller, A. J.	"Glenvale," Whittlesea
Mills, Robert	Naring East
Moore, Newton J.	Kawarren, via Colac
Mundy Bros.	Orbost
McInerney, M. J.	Nyarrin
Myers, F. P.	Bittern
McMillan, Walter N.	Moorooopna North
Nagle, E. V.	Bacchus Marsh
Noble, T. M., and Sons	Maffra
Northcote Children's Farm	Bacchus Marsh
Northey and Co.	Koorilla Park, via Bethanga
Osborne, L. R.	Strathfieldsaye, via Bendigo
Peters, W. H.	Heatherton
Petersen, E. V.	Korumburra
Richards, Albert H.	Dumbalk, via Meeniyan
Rintoul, J. T. C.	Glengarry
Roy, W. A.	Morrell's Hill, via Boolarra
Russell, J. A. and A. D.	Hendersyde, via Tatura
Sexton, John	Swan Marsh
Simspon, Ronald D.	Birregurra
State Experiment Farm	Ruthergien
Taylor, B. Hogan	Wandeen Farm, Harkaway
Trenery and Soderland	"Promview," Foster
Trigg, A. J.	Bungaree
Trigg, N. H.	Bullarook
Walsh, W. L.	"Twin Hills," Croydon
Warry, A. and Sons	Delburn
Whelpton, B.	Whittlesea North
Whytcross, D. J. (Jnr.)	Swan Marsh
White, G. W.	Boolarra South
Williams, A. W. and S.	"Hillview," Weerite
Williams, Geo. A.	Paternoster-road, Emerald

TUBERCLE-FREE HERDS

ACCREDITED TUBERCLE-FREE HERDS

The following herds have been declared free of tuberculosis under the *Accredited Tubercle-free Herd Scheme* conducted by the Department of Agriculture. Under this scheme a tubercle-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests or upon disclosure of infection, three semi-annual, successive, physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

Name.	Address.	Number in Herd.
Aboriginal Station	Lake Tyers	86
Ampt, E. W.	Gymbowen	12
Ampt, N. C.	Gymbowen	21
Ballarat Orphanage	Ballarat	139
Banyule Stud Pty. Ltd.	Wangaratta	55
Beggs, A. R.	Beaufort	116
Black, I. S., Estate of	Mount Noorat	64
Bleakley Bros.	Horsham	18
Bott, J.	Yarrawonga	70
Bruhn, C. H. and V. I.	Mirboo North	54
Candler, G. E.	Hamilton	35
Carne, W. J.	Pakenham Upper	30
Cason J. M.	Lima South	63
Clark, P. W., and Son	Whittlesea	95
Clark, W. J	Monomeith	142
Cowan, G. L. S.	Bacchus Marsh	61
Cox, F. G.	"Birradale," S. Lyndhurst	47
Cribbes, T.	Wangaratta	40
Deering, J. T.	South Wangaratta	79
Dookie Agricultural College (Ayrshire Herd)	Dookie	117
Dookie Agricultural College (Hereford Herd)	Dookie	38
Drechsler, W. P.	"Berry Bank" Swan Hill	102
Eagle, W. H.	Womerah	31
Everist, F. R.	Tyabb	12
Fixter, A.	Boisdale	26
Foletta, G. G., and Son	Buxton	121
Geelong Grammar School	Corio	81
Gilbert, J. A. and R. D.	"Brockelbank," Yinnar South	108
Gilmour, D. W. and N. B.	"Yarravale," St. Hubert's-lane, Yering	121
Gleeson, P. J., and Son	Tynong	261
Goddard, James H. & Sons	Cora Lynn	104
Gorman, A. W.	"Cathcart," Alexandra	57
Griffiths, J. G.	Benalla	121
Bross, Mrs. G. F.	Horsham	33
Hamilton, A.	Flinders	69
Haywood, A. R.	Mordialloc	184
Hicks, E. J. & Sons	Echuca	100
Henry, J. A.	Merrivale	40
Howlett, Mrs. G., and Miss E. Samuel	Lang Lang	84
Ivone, M., and Sons	Ovens	103
Jackson, H.	Lockington	81
Johnson, F. G.	Horsham	34
Jones, A. C.	Barnawatha	182
Keele, H. A.	Bamawm	79
Kelynack, P. T.	Bundoora	92
Kemp, E. J.	Horsham	16
Knglsey-Newell, F. J.	Shoreham	60
La Fontaine, G.	Mitta Mitta	61
Lawrence, P. H.	"Rainga," Tarrawarra	89
Lawton, W.	Frankston	56
Light, D. T.	Noradjuha	12
Longerenong Agricultural College	Dooen	49
Luke, K. G.	Romsey	32
Maloney, P. J.	Tongala	66
Maybery, A. H.	Mitre	13
Middleton, J. A.	Labertouche	80
Moore, J., and Co.	Yarram	109
Murray, M. G.	Lima	19
McIntosh, J.	Merrigum	77
McKenzie, A. E.	Kerang	54
McKenzie, Mrs. E. J.	Woodford	81
McKenzie, H. P.	Trawalla	15
McNabb, G. A., and Son	Irrewillipe East	196
Nancarrow Bros.	Kerang	56
Newton, J. M., and Sons	Whorouly	63
Nicholas, M. A.	Sherbrooke	79
Noonan, Mrs. S. A.	Benalla	68
Northcote Children's Farm	Bacchus Marsh	83
Onley, W. H.	"Glenholme," Caldermeade	88
Payne, A. E. T.	"Yarra View," Lilydale	78
Payne, T. E. N.	"Woodburn," Kilmore	72
Poole, M. A. and D.	Caldermeade	143
Poole, M. A. and D.	Yannathan	103
Potter, W. J.	Longwarry North	118
Price, L. E.	Ellerslie	78
Prosser, J. E.	Ondit	40
Read, exors., Estate I. D.	Springhurst	99
Rix, A. A.	Officer	79
Roe, Thomas H. P.	Cobram	15
Sanderson, R. F.	"Pleasant Hill," Kyneton	75
School of Horticulture	Burnley	7
Scott, A. L.	"Wolonga," Kongwak	43
Selwyn-Scott, F. E.	Scotsburn	66
State Experiment Farm	Rutherglen	49
State Research Farm	Werribee	203
Stephens, Dr. F.	Vermont	34
St. Joseph's Home	Sebastopol	59
Thomas and Taylor Pty. Ltd.	Hamilton	26
Till, J. A.	Tongala	58
Tucker, E. G.	Horsham	72
Vagg, T. R.	Officedale	56
Vagg, F. G.	Leongatha	57
Variety Investments Pty. Ltd.	Woori Yallock	127
Warnock, J. A.	Lima South	77
Waterhouse and Son	Pakenham	67
Williamson Bros.	Carlsbrook	119
Wilson, J. L.	Koo-wee-rup North	90

In addition to the above the following is a list of herds in their respective districts which have given negative reactions to two or more successive tests conducted by departmental veterinary officers, but, inasmuch as replacement cows are only submitted to one test before being admitted to the herds, they cannot be considered as accredited under the Accreditation Scheme which requires, among other things, that no cow shall be admitted to the herds unless it has given two (2) negative reactions at an interval of 60 days, and must be kept in isolation during the period between the two tests.

District.	Herds.	Cattle.
Ararat	11	291
Bairnsdale	4	109
Ballarat	122	3,050
Benalla	43	298
Bendigo	84	3,111
Broadmeadows	42	1,982
Colac	11	345
Doncaster	16	668
Geelong	101	3,692
Hamilton	2	94
Heidelberg	19	593
Horsham	9	468
Morwell	3	270
Orbost	1	99
Portland	7	431
Rutherglen	20	296
Sale	5	341
Terang	1	10
Traralgon	4	218
Wangaratta	38	475
Warrnambool	7	428
Whittlesea	105	4,485
Yallourn	4	269
Yarragon	36	1,630
Yea	26	73

There are also 419 herds in which 16,824 head of cattle have passed one test and may be considered, therefore, to be in process of becoming tubercle-free herds.

WHEAT CROP CHAMPIONSHIPS 1948

Wimmera, Mallee and Northern Districts

Twenty-two organizations, comprising Agricultural Societies and branches of the Victorian Wheat and Wool Growers' Association of Victoria competed in the District Wheat Crop Championship for the 1948-49 season.

Championships were held in the Wimmera, Mallee, and Northern Districts. The competition is for the best 50 acres of wheat exhibited in a local competition within the district concerned. Ten societies competed in the Wimmera Championship, five in the Mallee and seven in the Northern zone. In all a total of 272 crops were exhibited.

The competitions are conducted by the Farm Competitions Association of Victoria, which consists of representatives of the Department of Agriculture and Agricultural Organizations. The main objective is to collect and disseminate information regarding the methods used in the production of the best wheat crops. The championship is not judged solely on yield—other factors including the purity and type of seed, freedom from disease and weeds and general evenness of the exhibits are also taken into consideration.

Each of the championships is judged by an officer of the Department of Agriculture and the harvesting of the leading crops is supervised by Departmental officers who certify to the accuracy of the yields.

The Royal Agricultural Society of Victoria again donated prize money of £50 for each Championship, awarded on the basis of £25 to the grower of the champion crop and £15 and £10 to the Societies nominating the first and second-best crops respectively in the championship final.

The prizes for the championships were presented to the winning competitors and Societies at the annual conference of the Victorian Wheat and Wool Growers' Association held last month in the Assembly Hall, Melbourne.

THE WIMMERA CHAMPIONSHIP

Report of the judge, H. L. Hore, B.Agr.Sc., Senior Agronomist

APPROXIMATELY 1,000,000 acres of wheat have been sown in the Wimmera in each of the past four seasons. This area, which is slightly greater than that sown last season, has returned an average yield for the period, of over 18,000,000 bushels of wheat per annum, and it is estimated that the 1948–49 crop in this district will closely approach and may exceed the record crop of 21½ million bushels harvested two years ago.

SEASONAL CONDITIONS

The Wimmera district generally, experienced a very favorable season in 1948. Rainfall recordings for the year were from 2 to 6 inches above average over three-quarters of the area, but in the north-eastern quarter, in the Donald, Charlton, and Wycheproof districts, the season was not so favorable and recordings were lower than normal.

The first three months of the year were unusually dry, but heavy falls in April gave wheatgrowers the opportunity to cultivate their fallows and prepare the land for seeding. Rainfall in May and June was about normal and the crop was sown under favorable conditions. In a few districts, particularly around Goroke and Kaniva, some anxiety was experienced because of excessively wet conditions at seeding, and a few restricted areas could not be sown.

July rainfall was slightly below normal over the whole of the Wimmera and the recordings in August and September were both low. This dry spell continued into early October, but the rains earlier in the year, combined with mild weather, stood to the crops which showed little ill effects due to the dry spell except in the north-east quarter where, as mentioned earlier, rainfall up to this period was below normal. Heavy rains in the latter half of October and norma

falls in November, combined with a continuance of mild weather, resulted in high average yields and record wheat production in many districts.

The table on this page shows the rainfall recordings for 1948 at thirteen centres in the Wimmera together with the long-term average at each centre. Recordings for the months of June to November inclusive are also shown, and this period can be taken as the sowing and growing period of the crop in this part of the State. It will be observed that the rainfall during the growing period was only slightly above average at most centres; the distribution of the falls, good pre-seeding rains and mild conditions over a long ripening period favored heavy crop development.

WIMMERA RAINFALL (IN INCHES).

For 1948 and long-term average.

Centre.	Total for Year.		June to November.	
	1948.	Average.	1948.	Average.
Kaniva ..	20·8	17·8	12·3	11·2
Nhill	20·7	16·3	10·6	10·0
Dimboola ..	20·2	16·0	10·6	9·8
Goroke ..	22·9	20·2	12·6	13·0
Natimuk ..	23·6	17·4	13·4	10·7
Horsham ..	20·2	17·7	10·6	10·6
Murtoa ..	17·9	16·0	11·1	9·4
Rupanyup ..	18·2	16·6	11·2	10·0
Jeparit ..	18·3	14·9	10·7	8·7
Warracknabeal ..	18·4	15·1	11·5	9·0
Donald ..	14·5	15·8	9·5	9·4
Charlton ..	16·8	16·6	10·6	9·7
Wycheproof ..	13·6	14·4	8·7	8·5

Loading wheat into a truck equipped for bulk carting.

WHEAT VARIETIES

Quadrat was sown on 61·2 per cent. of the area sown to wheat in the Wimmera in 1948. In the competition crops, Quadrat was sown in 72 of the 142 crops inspected and 4½ of the 10 winning crops were sown with this variety—in 7½ instances it was placed either second or third.

The most outstanding wheat variety in the Wimmera last season was the comparatively new variety Pinnacle. This wheat gave the highest yields of the named varieties in experimental plots conducted by the Department of Agriculture at Longerenong College, Warracknabeal, Donald, and Charlton. It was also prominent in the plots at Salisbury and Kaniva.

Pinnacle also greatly enhanced its reputation during the past season by its performance in crop competitions, winning four of the ten competitions in the Wimmera, as well as the Championship. It was placed second or third in a further eight of the competitions. The total number of crops of Pinnacle exhibited was 31½. An analysis of the varieties exhibited in local competitions in the Wimmera in 1948 is given in the table.

Pinnacle is one of four wheats recommended by the Victorian Wheat Advisory Committee for general sowing on black soils in the Wimmera. The other three are Quadrat, Magnet, and Diadem. These four varieties are also recommended as suitable for the red and fringe soils of the Wimmera. An indication that farmers there find these wheats satisfactory is given by the fact that over 90 per cent. of the one million acres sown to wheat in the Wimmera in the 1948–49 season was sown with the varieties Quadrat, Pinnacle, Magnet, Diadem, and Ghurka. Of these varieties Ghurka has shown a marked decline in popularity in recent years and is rapidly being replaced by others of the varieties mentioned. Magnet too, has shown a decrease in popularity in the Wimmera generally, although this variety is still highly regarded in the western Wimmera, between Nhill and the South Australian border.

Harvesting the Kaniva entry in the Wimmera championship. This crop gained second place (62·4 bus./ac.).

In this area, it has been outstanding in yield in the experimental plots and on the farms.

The yields obtained with the main wheat varieties in the trials conducted by the Department at six centres in the Wimmera are given below. For convenience, they have been divided into tests on Wimmera black land and on other soil types.

WIMMERA TESTS ON BLACK LAND.

(*Wheat Yields in Bushels per Acre.*)

Variety.	Longerenong.		Salisbury.		Kaniva.	
	1948.	Average 7 Years, 1941–48.	1948.	Average 8 Years, 1941–48.	1948.	Average 7 Years, 1942–48.
Pinnacle ..	62·9	35·1	51·2	37·0	70·7	42·4
Quadrat ..	60·6	33·8	50·1	36·7	62·0	40·7
Magnet ..	57·5	32·3	55·9	36·9	72·8	43·0
Ghurka ..	58·6	31·5	48·3	34·6	59·5	38·1
Diadem ..	55·7	32·3	44·3	32·9	63·6	37·7

In additon to the above varieties, Insignia has been included in these tests for a number of years. Although this variety has given high yields in some years, its performance over a period of years does not warrant its recommendation for heavy black soils in the Wimmera.

The variety Diadem, a cross between Ghurka and White Fife, is the latest variety to be released by the Department of Agriculture to Wimmera farmers. It is a wheat which embraces the prolificacy of Ghurka with the high flour-quality of White Fife. Diadem has given yields equal to Quadrat and Magnet, and much better than Ghurka, over a period of several years at Longerenong, Warracknabeal, Donald, and Charlton. Farmers who have not yet sown this wheat are advised to give it a trial.

WHEAT VARIETIES IN LOCAL COMPETITIONS IN THE WIMMERA, 1948.

District.	Variety.						
	Quadrat.	Pinnacle.	Magnet.	Diadem.	Ghurka.	Baldmin.	Bencubbin.
Dimboola	1½	6*	2	½	..	..	..
Goroke	4½*	1½	1½*	½	..	..	..
Natimuk	5½*	1½	1	..	..	..	..
Warracknabeal	12*	2½	..	3½	..	..	..
Donald	8*	1	..	1	..	..	..
Rupanyup	10	2*	..	..	..	..	..
Kaniva	4	2	6½*	1½	..	..	..
Horsham	2½	5*	1	½	..	1	..
Murtoa	3	1*	..	2	1	..	..
Nhill	25*	9	8	2	..	..	1
Total	76	31½	20	11½	1	1	1

* The winning variety in each district competition.

WIMMERA TEST ON SOILS OTHER THAN HEAVY BLACK LAND.

(*Wheat Yields in Bushels per Acre.*)

Variety.	Warracknabeal.		Donald.		Charlton.	
	1948.	Average 3 Years, 1946–48.	1948.	Average 3 Years, 1946–48.	1948.	Average 7 Years, 1942–48.
Pinnacle ..	44·6	31·4	32·4	28·9	29·5	22·8
Quadrat ..	40·2	30·7	29·6	27·5	28·4	23·1
Diadem ..	40·2	31·0	29·2	29·5	26·1	22·5
Insignia ..	34·9	27·6	28·7	29·4	22·4	24·1
Magnet ..	36·8	29·2	31·0	28·9	26·9	21·9
Ghurka ..	36·4	28·0	28·1	27·3	26·8	21·6
Bencubbin	30·9	27·7	25·9	27·2	20·5	19·9

"FOOT-ROT" AND "TAKE-ALL"

Many of the crops in the Wimmera last season showed quite an appreciable infection with "foot-rots" and "take-all," which showed up as deadheads in the crop and, in the more serious cases as thin patches and almost bare areas among the wheat.

Take-all and foot-rots are caused by a group of fungi which usually harbor in the soil and attack the wheat through the roots and basal portions of the plant. Although infection most frequently takes place in the early stages of growth, the plant may be sufficiently strong to show no outward manifestation of the disease until such time as it experiences some check in growth, due for example to excessively wet, excessively dry, or other unfavorable environmental conditions.

If such conditions are met very early in the growth of the plant, or if infection is severe, the plant may die in the seedling stage. Development may be arrested at any stage right up to the formation of the grain in the head, and when manifest at this stage, the heads fail to develop grain and usually appear as light-colored ears scattered throughout the crop.

Take-all of wheat (*Ophiobolus graminis*) is carried over from crop to crop in the ground, on the straw and roots of infected plants and on host plants such as barley grass and spear grass. Infection of the wheat crop does not occur through spores of the disease carried over on the grain used as seed. The group of organisms causing "foot-rot," generally carry over in the same manner as described for take-all, but it has been shown that at least one of the "foot-rots" (*Helminthosporium sativum*) can be carried over on the grain. Many samples of wheat inspected this season contained grains showing a black or dark-brown discoloration on the grain end or along the crease. In some cases this was due to a disease known as "black point" which is the name given to grains infected with the "foot-rot" fungus mentioned above.

Naturally, when available, it is preferable to use seed showing no trace of "black point," but if wheat containing grains so affected is used for seed it is a wise precaution to thoroughly pickle with a suitable organic mercury pickling powder instead of the copper pickling powders commonly used for the prevention of stinking smut or bunt.

Pickling of seed wheat with mercury powders has been shown to prevent infection of the young plants by the "foot-rot" fungus carried on the grain, and to give an effective control of ball smut, but of course it will not prevent infection of the wheat plants by "foot-rot" which may be already established in the soil. Clean, well-worked fallows, adequate manuring and good farming practices generally, assist in reducing the severity of both "foot-rot" and "take-all" attacks on the wheat crop.

THE CHAMPIONSHIP ENTRIES

As indicated earlier, ten agricultural societies, representing most districts of the Wimmera, competed in the championship. The Charlton Agricultural Society, which has been represented each year since the inception of the championship in 1938, did not participate in 1948. The Rupanyup Agricultural Society, participating again after an absence of some years from crop competitions, was represented by a very creditable entry.

The most outstanding feature of the Wimmera crop competitions in general and the championship exhibits in particular, last season, was the exceptionally high yield of the crops. The average yield of the ten crops in the championship would be approximately 52 bushels per acre over the competition area of at least 50 acres, and the crops placed first, second, and third, each yielded over 60 bushels per acre.

Favorable seasonal conditions contributed largely to the production of these phenomenal yields, but one cannot fail to be impressed by the high yielding ability of modern wheat

varieties, the methods of farming used by these wheatgrowers and the fertility of the soil which, after years of wheat growing, can produce such crops.

The champion crop of the Wimmera, 1948.

THE CHAMPION CROP

The champion wheat crop in the Wimmera for 1948 was grown by Mr. W. E. Dahlenburg of Dahlen, near Horsham. The variety grown was Pinnacle and the crop, harvested under the supervision of Mr. L. M. Needham, Field Officer of the Department of Agriculture, yielded 68·5 bushels per acre—a record for Victorian wheat crop competitions.

The area of the Champion crop was 52 acres, but a further 30 acres of crop which was equally good was cut off to facilitate harvesting. The crop was clean, dense, and the only uneveness apparent was caused by a few trees growing in the area. Purity of the seed was very good and the grain harvested showed a bushel weight of 63 lb.

The crop was grown on Wimmera black soil which has been worked a three-course rotation of fallow-wheat-pasture for many years. In 1947 the paddock was skeleton-board ploughed to a depth of 4 inches in May, scarified in June, August, and October, harrowed with points attached in November, December, and February, 1948. Late in April it was cultivated with a springtyne, then harrowed again in May and the crop "combined in" during the first week in June with 70 lb. of dry pickled seed and 112 lb. of superphosphate plus 10 lb. of zinc sulphate per acre, respectively. Four days after sowing, the paddock was harrowed, and late in July the crop was fed off with sheep to consolidate the soil.

Mr. W. E. Dahlenburg examines grain from his champion crop. Yield 68·5 bus./ac. Bushel weight 63 lb. Protein 11·1 per cent.
[Herald-Sun photo.

COMMENTS ON OTHER CROPS

The second award was gained by Mr. A. G. Mock of Kaniva, with a crop of Magnet wheat which, despite a severe attack by cut-worm grubs just before harvest, returned a certified yield of 62·4 bushels per acre. The grubs crawled up the stems and ate through the stalks, causing the heads to fall. The loss in yield in this crop could be measured in bags per acre. This crop was clean and particularly well headed and produced an excellent sample weighing 64½ lb. per bushel.

Mr. Mock's crop was grown on a paddock of black land which, prior to fallowing in 1947, was out to grass for five years. Preparation of the land comprised a discing to a depth of 4 inches in March, 1947, "combining" early in May, scarifying in August, "combining" and two workings with shear harrows before harvest. In 1948 it was scarified in February, combined again in May and the crop combined in mid-June with 75 lb. of dry-pickled seed and 1 cwt. of superphospate per acre. Zinc had previously been used in this paddock, but none was applied with this crop. The crop was not fed off.

The Dimboola entry. Mr. H. E. Holland in his crop of Pinnacle which yielded 60·5 bus./ac.

Mr. H. E. Holland, a competitor in the Dimboola Society's competition, was placed third in the championship. His crop, which was also of Pinnacle wheat, returned a certified yield of 60·5 bushels per acre. Mr. Holland's crop was a particularly even and attractive one, grown on land which has been farmed to include as much time out to pasture as was practicable. During the past nine years, it had been out to pasture for two periods amounting to five years, fallowed twice and had grown two wheat crops.

The fallow was ploughed in August, harrowed three times in September, scarified in October-November, and then harrowed again early in December and later scarified. It was shear-harrowed in April and in May and sown in mid-June with 80 lb. of dry-pickled seed and 90 lb. of superphosphate per acre.

The names of the other competitors who had the honor of representing their districts in the championship together with varieties of wheat shown in each case, are given in the table at foot of this page.

An interesting feature of the wheat harvested from the championship crops was that the high yields were associated with a protein content above that for wheat from the district generally. Analysis of the grain from the winning crop showed 11·1 per cent. protein and the grain of the crops placed second and third was also slightly higher in protein than samples taken this season from the grain elevators serving the districts concerned.

The winners of the Wimmera Championship since the inception of the competition are set out in the table.

CHAMPIONSHIP WINNERS, 1938–48.

Year.	Winner.	Agricultural Society.	Variety.	Certified Yield.
				bus./ac.
1938	H. Cramer ..	Nhill ..	Ghurka	32·5
1939	L. H. Clark ..	„	„	49·3
1940	C. P. Dahlenburg	„	„	35·1
1941	V. H. Baldock ..	Kaniva	Magnet	45·7
1946	C. H. Champness	„	Magnet and Quadrat	53·8
1947	H. F. Budde ..	Dimboola	Quadrat	46·1
1948	W. E. Dahlenburg	Horsham	Pinnacle	68·5

Mr. A. G. Mock's crop of Magnet; yield 62·4 bus./ac.

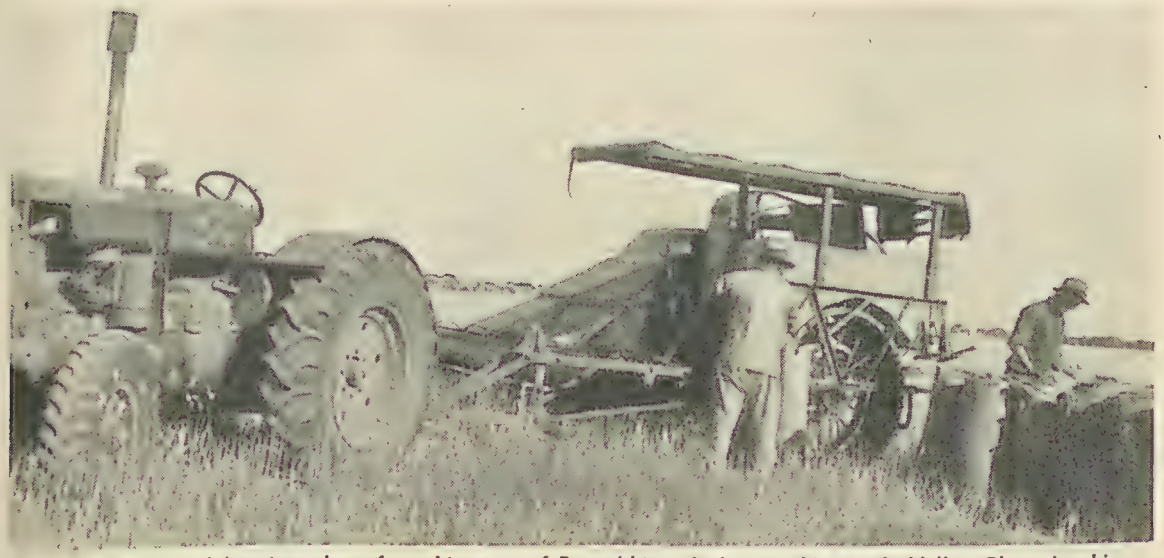
WIMMERA CHAMPIONSHIP ENTRIES, 1948.

District Agricultural Society.	Number of Crops in Local Contest (50 Acres).	Representative in Championship.	Variety.	Certified Yield.
				bush./acre.
Horsham	10	W. E. Dahlenburg, Dahlen ..	Pinnacle	68·5
Kaniva	14	A. G. Mock, Kaniva	Magnet	62·4
Dimboola	10	H. E. Holland, Wail	Pinnacle	60·5
Murtoa	7	G. E. Schache, Murtoa	Pinnacle	..
Warracknabeal ..	18	L. R. Rodda, Aubrey	Quadrat	..
Goroke	8	L. T. Johnson, Kangawall ..	Quadrat and Magnet ..	..
Natimuk	8	R. E. Hateley, Natimuk	Quadrat	..
Rupanyup ..	12	W. R. Oram, Rupanyup	Pinnacle	..
Donald	10	D. Wells, Swanwater West ..	Quadrat	..
Nhill	34*	J. R. Dahlenburg, Salisbury ..	Quadrat	..

* These represented 43 entries—there were also eleven crops in the 25-acre sections for red land.

THE MALLEE CHAMPIONSHIP

Report of the judge, H. J. Sims, M.Agr.Sc., B.Com., Cerealist



Mr. M. W. Gniel bagging wheat from his crop of Bencubbin, which won this year's Mallee Championship. The certified yield was 32·8 bushels per acre.

WHEAT crop competitions were conducted in five Mallee districts in 1948, and the winner of each competition represented his district in the Mallee Wheat Crop Championship. This was won by Mr. M. W. Gniel of Rosebery, who was nominated by the Beulah Agricultural and Pastoral Society.

Mr. R. A. Boehm, representing the Hopetoun Agricultural and Pastoral Society was placed second, while third place was gained by Mr. J. M. Cooper, winner of the Nullawil district competition.

The other finalists in the Championship were Mr. J. Williams, representing Walpeup district, and Mr. G. D. Brydon, whose entry was sponsored by the Swan Hill Agricultural and Pastoral Society.

In all, 42 crops each of 50 acres, were entered in the five local competitions. This represented a substantial increase in the number shown in the previous year, when 31 crops were judged. In three of the district competitions, entries were smaller than last year, mainly because the unfavourable weather conditions in the early spring caused serious deterioration in the yield prospects of some farmers who are normally entrants in these competitions.

MALLEE WHEAT CROP CHAMPIONSHIP—ENTRIES 1948.

District.	Number of Crops in Local Contest.	Representative in Championship.	Variety.	Certified Yield.	Total Points Allotted
				bus./acre.	
Beulah	4	M. W. Gniel, Rosebery ..	Bencubbin ..	32·8	96
Hopetoun	4	R. A. Boehm, Hopetoun ..	Quadrat ..	25·5	87
Nullawil	4	J. M. Cooper, Nullawil ..	Ranee 4H ..	25	86
Walpeup	12	J. Williams, Walpeup ..	Insignia ..	24	84
Swan Hill	18	G. D. Brydon, Swan Hill ..	Insignia and Quadrat	19 (est.)	81

SEASONAL CONDITIONS

The 1948 rainfall in most Mallee districts was below average. Practically no rain was recorded during the first three months, but good opening falls were received in April, and satisfactory rains continued through May and June. The rainfall in July, while below normal, was sufficient to maintain growth, but the continued lack of rain in August and September seriously affected the crops. In the south-western area, the spring rains were somewhat better than elsewhere, and the crops there were less affected than in other districts. Conditions in the spring were particularly severe in the eastern Mallee. Good rains in October enabled many crops, particularly in the southern Mallee, to recover to some extent, and certainly assisted crops in all districts to finish well.

Final yields in the Walpeup, Hopetoun, and Beulah districts were generally regarded as satisfactory, but overall yields in the Swan Hill and Nullawil districts were considerably below average. In all districts, the grain was plump, of good color and had a high bushel weight.

The rainfall for 1948 (in points) in the five districts competing in the Championship was as set out in the table.

RAINFALL FOR 1948 IN MALLEE COMPETITION AREAS

——	Beulah.	Hopetoun.	Nullawil.	Swan Hill.	Walpeup.
January ..	9	3	15	9	16
February ..	37	72	50	12	20
March	6	6	0	0	8
April	195	126	116	115	115
May	142	104	78	130	156
June	175	187	196	112	152
July	139	81	67	41	99
August	84	41	24	23	53
September ..	58	41	24	86	59
October ..	396	328	259	242	350
November ..	127	91	71	92	114
December ..	131	113	70	210	111
Total (1948) ..	1,499	1,193	970	1,072	1,253
Total April–Oct. (1948) ..	1,189	908	764	749	984
Average annual rainfall ..	1,429	1,298	1,362	1,295	1,263
Number of years used in compiling average ..	44	47	43	59	37

VARIETIES SOWN IN THE COMPETITION

Nine different varieties of wheat were sown in the local competitions participating in the Mallee Championship. The varieties exhibited are tabulated below:—

Insignia, the variety most favoured by competitors, was released for sowing as recently as 1946. It has rapidly increased in popularity in the three seasons since its release, and was sown on 330,000 acres or 25 per cent. of the Mallee area in 1948. It is considered that the area sown to this variety will continue to increase during the next few years.

The varieties of wheat recommended by the Victorian Wheat Advisory Committee for sowing in the Central and Southern Mallee are Insignia, Bencubbin, Quadrat, Pindar, and, for trial, Diadem. Of these, Insignia is the earliest to mature, while Bencubbin is considerably earlier than Quadrat, Pindar, and Diadem. All of these

WHEAT VARIETIES IN LOCAL COMPETITIONS IN THE MALLEE, 1948.

District.	Variety.								
	Insignia.	Quadrat.	Bencubbin.	Ranee 4H.	Diadem.	Pinnacle.	Pindar.	Sepoy.	Gabo.
Swan Hill.. ..	7½	7	..	..	1	1½	1	..	..
Walpeup	7½	2	1½	..	..	..	..	½	½
Nullawil	..	2	..	2	..	..	..	..	..
Hopetoun	1½	2	..	..	½	..	..	..	..
Beulah	1½	½	2	2	..	..	..	..	..
Total ..	18	13½	3½	2	1½	1½	1	½	½

last named are late midseason varieties. Of the three, Quadrat is the latest in ripening.

Varieties which won the various local competitions were Bencubbin (this variety also won the championship), Insignia, Quadrat and Ranee 4H.

Yields obtained from standard varieties of wheat in the experimental plots conducted by the Department of Agriculture at various centres in the Mallee are listed hereunder.

Mr. R. A. Boehm harvesting his crop of Quadrat. This crop, which yielded 25½ bushels per acre, was placed second.

CHAMPIONSHIP FINAL CROPS

The farm on which Mr. M. W. Gniel's crop was grown was purchased by him in 1947. While no fixed rotation had been used by the previous owner, approximately one-third of the area was sown to wheat each year. Mr. Gniel is now resubdividing the farm. The section on which the Champion crop was grown had been cropped in 1946.

The competitor placed second in the Championship, Mr. R. A. Boehm has worked his farm on a fallow-wheat basis, with one exception, since he purchased it nine years ago. A stubble-sown crop (portion wheat, portion oats), was sown in 1946.

Mr. J. M. Cooper's paddock had not been cropped to wheat since 1943. The 1944 oat crop failed owing to drought, and the area resown to oats in 1945, while self sown oats were fed off in 1946.

The paddock shown by Mr. J. Williams had been cropped to wheat in 1946, but prior to the fallowing for that crop. it had been left out to grazing in 1944 and had been sown with oats in 1943.

A three-course rotation, fallow-wheat-oats, is generally adopted by Mr. G. D. Brydon. The only departure from this in recent years was that, following the failure of the 1944 wheat crop, which was fed off, the paddock was again sown to wheat in 1945.

WHEAT VARIETY TRIALS AT MALLEE CENTRES.
(*Results in bushels per acre.*)

Variety.	Walpeup (Average 6 Years, 1943–48).	Woomelang (Average 6 Years, 1943–48).	Ultima (Average 6 Years, 1943–48).	Berriwillock (Average 5 Years, 1944–48).	Manangatang (Average 3 Years, 1946–48).	Murrayville (Average 3 Years, 1946–48).
	bush./acre.	bush./acre.	bush./acre.	bush./acre.	bush./acre.	bush./acre.
Insignia	15·0	20·2	11·6	17·7	23·1	17·6
Bencubbin	13·4	18·2	10·1	14·6	23·9	15·8
Ranee 4H	11·6	17·1	9·3	14·6	17·5	15·6
Regalia	12·0	17·1	9·7	14·8	18·7	13·4
Quadrat	14·4	17·1	9·6	16·1	19·7	18·4
Pindar	12·3	15·9	8·4	14·5	17·6	15·6
Diadem	12·4	16·6	9·0	..	..	..
Pinnacle	12·6	16·0	8·4	14·1	17·6	15·6

CULTIVATION PRACTICES

An examination of the methods used by the ten leading competitors in the local competitions, showed that fallowing was carried out in the following months:—June (one), July (six), and August (three). Thus the best crops were grown on early fallows. Nine of the fallows were prepared with a twin disc or undercut-type plough, the remaining one was prepared with a scarifier.

The subsequent workings of the fallows were done mostly with the scarifier; the springtooth was used on some occasions, particularly for the after-harvest workings. In one case the second working was given with the undercut, while one competitor used tandem-disc harrows for all subsequent workings. Cultivations given after the initial breaking of the ground varied between one and four. Two paddocks received one cultivation, three had two cultivations, while five were given four cultivations.

The chief objective of cultivation is to control weed growth and prepare a satisfactory seedbed. These objectives should be achieved with a minimum number of workings. Additional workings add to the farmer's costs and may result in increased soil erosion.

All crops were sown in May, the majority being sown during the first half of the month. Seeding rates varied from 45 to 75 lb. per acre, the average rate of sowing being 60½ lb. per acre. The superphosphate dressing averaged 63½ lb. per acre, the range being from 45 to 80 lb. per acre.

THE CHAMPION CROP

Mr. M. W. Gniel's crop of Bencubbin was outstanding in regard to yield. Harvested under the supervision of the judge, it yielded 32·8 bushels per acre. The grain was bright and plump, and weighed 66 lb. per bushel. The protein content of the grain was 8·6 per cent., while the Pelshenke time (an indication of baking quality) was 32 minutes.

The land on which this crop was grown was disc-ploughed in June, harrowed in July, disced in September, scarified in November, springtooth-cultivated late in February and combined in during the second week in May, using 70 lb. of copper-pickled seed and 80 lb. of superphosphate per acre.

The crop did not appear to have suffered appreciably during the dry weather in the spring. Purity and type were quite good; the crop was practically free from disease, but some weeds, mainly mustard, were present.

THE OTHER CROPS

Second place was gained by Mr. R. A. Boehm with a crop of Quadrat that yielded 25½ bushels per acre. The crop was rather uneven, and contained patches of very heavy crop. The grain was not as bright as from the winning crop, as many grains were affected with "black point." The bushel weight was 66 lb. while the grain contained 11·2 per cent. protein.

The fallowing was done with a twin-disc at the end of July. A working was given at the end of September; portion of the area was scarified, the remainder springtoothed. It was springtoothed again in April and sown during the second week in May with 60 lb. of copper-pickled seed and 50 lb. of superphosphate per acre.

Third place went to Mr. J. M. Cooper, whose crop of Ranee 4H yielded 25 bushels per acre. The crop was well grown considering the seasonal conditions. The growth of the crop was assisted by the nature of the paddock—which is more sandy than the average of the district.

The grain was of good appearance, weighing 67 lb. per bushel, and had a protein content of 9·9 per cent. The paddock was scarified in July (being previously oats-grazed land), and was scarified again in early October. Sowing was done in the first week of May, using 50 lb. of seed and 60 lb. of superphosphate per acre. The paddock was harrowed a week after sowing.

Mr. J. Williams showed a well-grown and well-headed crop of Insignia which yielded 24 bushels per acre. Mr. G. D. Brydon's crop of Insignia and Quadrat was estimated to yield 19 bushels per acre. Considering the early spring rainfall in these two districts these crops were considered very creditable.

Competition Winners, 1939–48.

The winners of the Mallee Championship since the inception of the competition are as follows:—

Year.	Winner.	District.	Variety.	Certified Yield.
				bus./ac.
1939	G. S. Mahar	Kerang ..	Ghurka ..	36·0
1940	C. E. Carra..	Hopetoun	Ghurka ..	24·2
1941	C. E. Carra..	Hopetoun	Bencubbin	31·0
1946	F. J. Hofmaier	Beulah ..	Bencubbin	28·5
1947	Mrs. A. Olsen	Swan Hill	Quadrat	33·1
1948	M. W. Gniel	Beulah ..	Bencubbin	32·8

NORTHERN DISTRICT CHAMPIONSHIP

Report of the judge, J. A. Morrow, B.Agr.Sc., Senior District Agricultural Officer

Harvesting a heavy crop of wheat in the Dookie district.

SEVEN agricultural societies in the Northern District conducted wheat crop competitions and competed in the Wheat Crop Championship for 1948. Competition was increased this season by nominations from the Boort and Nurmurkah Agricultural Societies, while Dookie, Rutherglen, Wangaratta, Maryborough, and Yarrawonga were again represented. In each case the crop nominated by the respective Agricultural Society was the winner of the local competition.

The area covered by the Northern District Championship is large, and is representative of a wide range of soil types, rainfall and farming conditions. The Boort district, for example, with an average annual rainfall of 15½ inches (it was only 13½ inches in 1948), competed with districts with a rainfall of over 20 inches. Although yields in that district were considerably lower than those of districts with more favorable rainfall and richer soils, the winning crop in the local competition was nevertheless very creditable. It is perhaps unfortunate that the Boort district should first enter the competition at a time when the season in the Northern district was favorable to the production of record crops.

The variation in the rainfall and soil type is reflected in the methods of wheat growing in the various districts. In the lower rainfall districts of which Boort is a typical example, wheat is usually grown on fallow, normally in a fallow-wheat or fallow-wheat-oat rotation. There is a growing appreciation of the desirability of giving the land a spell, and interest is increasing in pasture types to make best use of the land when out to pasture.

Wimmera rye grass is sown on some farms, but to date no satisfactory legume, other than the naturally occurring, has been found to make possible a modified form of the clover-ley rotation as practised in the Rutherglen and Wangaratta districts. In these north-eastern areas, it is customary for land, after cropping to cereals for some

years, to be sown to subterranean clover and to be allowed to revert to pasture for several years. Improvement in fertility due to the clover has resulted in some spectacular increases in yield, and has led to the wide adoption of clover-ley farming.

Results at Rutherglen Research Station have shown that it is possible to grow several crops without fallow after clover-ley before any decrease in soil fertility (as shown by falling wheat yields), becomes apparent. This has resulted in a system of cropping in which two or three crops are taken from a paddock, which is then given another "spell" under clover pasture before cropping is resumed.

It is noteworthy that Mr. G. Pearce of Springhurst has adopted clover-ley farming and has won the Rutherglen Competition in both 1947 and 1948 with crops grown on the same ground without fallow. The clover-ley system could be adopted, without much modification, to parts of the Maryborough district. To be successful, however, the pastures would need adequate topdressing with superphosphate to ensure vigorous growth of the subterranean clover.

A modified form of clover-ley farming has been tried with success in the Dookie district. At Dookie, as in the Yarrawonga and Nurmurkah districts, fallowing is still considered necessary in normal seasons to give satisfactory wheat yields. In the greater portion of these districts the growth of subterranean clover is not good enough for the adoption of clover-ley farming with this species, but by encouraging the natural trefoils and spelling the land, it is possible to arrest the decline in fertility caused by consistent cropping.

The adoption of a system in which the land is given periodical "spells" under pasture has also had the effect of reducing wild oat infestation, and could well be considered by many farmers who have found their cultivation methods ineffective.

The crops exhibited throughout the competition were of a uniformly high standard and all gave evidence of careful attention to purity of seed and control of weeds.

THE CHAMPION CROP

The championship was won by Mr. R. W. Thomas of Dookie with a particularly fine crop of Baldmin. The measured yield of 63·7 bushels per acre constitutes a new record for Northern District crop yields. The crop was exceptionally well headed and was dense and even. There was a tendency for this crop to lodge slightly in places, but little grain was lost from this cause.

A few wild oats and an odd thistle were noticed, otherwise the crop was clean. In common with the other crops competing in the championship, the winning crop was particularly free from "strangers". Disease was limited to a few heads showing loose smut. The crop was grown after fallow on black land which had been fairly regularly cropped for several years.

COMMENTS ON OTHER CROPS

Second place was awarded to Mr. P. F. Sims of Springhurst representing the Wangaratta A. and P. Society. This competitor's crop of Magnet, though yielding considerably less than the winning crop, was also very clean and free from weeds.

Patches of "take-all" would cause some reduction in yield and there was a tendency for the crop to thin off towards the higher portions of the paddock. Notwithstanding these minor defects the crop was well up to competition standard and compared favorably with winning crops of other seasons.

The Wangaratta A. and P. Society has the distinction of nominating two champion crops and a second placing in the three years in which the Northern District Championship has been decided.

With the exception of the Boort entry, there was little to separate the second-placed competitor from the remainder of the entries. The high standard of the competing crops was a pleasing feature of the competition and emphasized the value of thorough methods of cultivation which will produce good results under most diverse conditions.

The diversity of methods adopted by the competitors indicates that for best results farming methods must be adapted to suit varying conditions of soil and climate, and also that the method adopted must be thoroughly carried out if fertility and yielding capacity are to be maintained.

(continued on page 162.)

VICTORIAN F.A.Q. WHEAT

Analysis of 1949 Sample

By E. J. O'BRIEN, A.A.C.I., Cereal Chemist

A portion of the official F.A.Q. wheat sample, supplied by the Victorian Chamber of Commerce, has been critically examined. The results of analysis and of milling and baking tests are compared with those of the previous seven years in the following tables. The official sample represented a Victorian wheat crop of approximately 46 million bushels, and was made up from 250 individual samples from various districts mixed in the following proportions :—

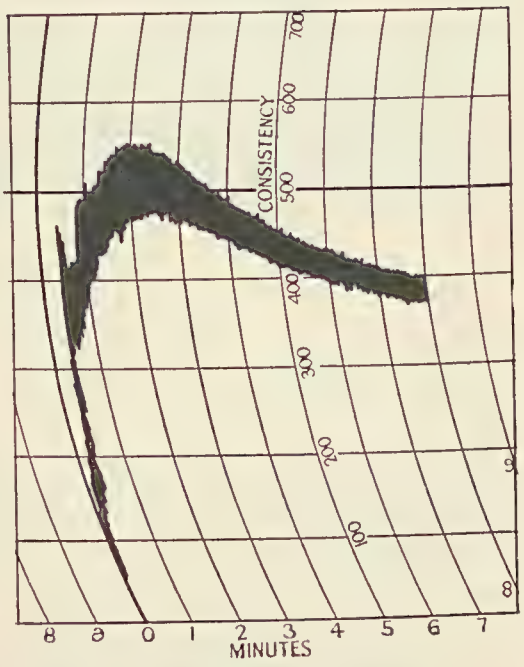
Mallee 26 per cent., Wimmera 44 per cent., Northern 12 per cent., North-east 15 per cent., South Central 3 per cent.

WHEAT

The colour is moderately bright and the grains are well filled. The bushel weight, which was struck at 63 lb., although much higher than last year, is reduced by the presence of bleached wheat from the Wimmera. Heavy rain during the harvest period is indicated by the presence in the sample of some bleached grains and an occasional grain with traces of black mould in the crease and on the beard end.

Grains showing black or dark brown discolouration on the germ end are present in greater numbers this season, probably due to the wet conditions prevailing last October and November in some districts. This discolouration is due to a disease known as "black point", caused by a fungus (*Helminthosporium sativum*) which is responsible for "foot rot" and "dead heads" in the crop. These fungus infections are undesirable but, in the small amounts present in the F.A.Q. sample, have no important effect upon the milling or baking values of the wheat. However, if a high proportion of wheat is affected with "black point" the bran and pollard may be somewhat discoloured, although the flour quality is not changed.

The amount of impurities, though relatively small, included some saffron thistle and long-fruited wild turnip seeds and several



Farinogram of 1949 sample of F.A.Q. wheat.

seeds of melilotus. Saffron thistle is often difficult to remove from wheat but the other small seeds are easily removed by normal cleaning machines. However melilotus is particularly objectionable, as relatively small amounts can impart a taint to large quantities of wheat if the grain is damp or if the wheat and melilotus are damp-conditioned in a mill. When seasonal conditions favour this weed, farmers should take particular care that the small olive-green seeds of melilotus are excluded from their wheat deliveries.

The quantity of protein is 0·7 per cent. higher than last year but its quality is somewhat inferior as shown by a lower Pelshenke figure.

FLOUR

The cleaned, conditioned wheat milled readily to yield a normal quantity of bright flour. The diastatic activity, as measured by maltose figure and gassing

power, is low and is inadequate for satisfactory bread production. Malt additions will therefore be necessary in the bakery. The protein while significantly higher in quantity than last year is of inferior quality as shown by the Farinograph data. The water absorption, which is dependent upon the quantity and quality of the protein, is low, as is also the Valorimeter Number. Consequently the results indicate that the low water absorptions and critical mixing times experienced by bakers last year will be carried on again this year.

Baking results were not quite as good as for the corresponding sample last year. The addition of malt-phosphate caused an increase in volume indicating that, as usual, an improvement in baking can be effected by increasing diastatic activity and by the addition of yeast foods. The flour failed to give a positive response to the addition of bromate, suggesting that this season's flour will not improve much with age. In so far as a season's wheat can be represented by a single sample, the baking and analytical results indicate that an average flour will need careful handling to produce satisfactory bread.

TABLE 1.—ANALYTICAL RESULTS—WHEAT.

—	1942.	1943.	1944.	1945.	1946.	1947.	1948.	1949.
Moisture (per cent.)	10·5	11·2	11·2	11·8	11·7	11·2	11·6	11·7
Impurities (screenings) (per cent.) ..	5·3	3·7	4·9	4·1	4·7	3·9	5·9	4·0
Ash (per cent.)	1·23	1·20	1·20	1·19	1·36	1·22	1·22	1·33
Protein (N x 5·7 per cent.)	10·3	11·1	10·4	11·5	11·8	11·2	9·8	10·5
Bushel weight (lb.)	63¾	64¼	65	63½	62½	63½	60½	63½
Pelshenke figure (min.)	32	33	37	35	32	38	36	34

TABLE 2.—ANALYTICAL RESULTS—FLOUR.

—	1942.	1943.	1944.	1945.	1946.	1947.	1948.	1949.
Moisture (per cent.)	13·2	13·6	13·4	13·4	14·0	13·5	14·4	14·0
Yield (per cent.)	70·0	71·7	70·0	72·0	70·3	70·3	70·0	70·0
Ash (per cent.)	0·48	0·46	0·40	0·44	0·43	0·41	0·40	0·46
Protein (N x 5·7) (per cent.) ..	9·0	10·0	9·0	10·3	10·5	9·5	8·2	9·2
Wet Gluten (per cent.)	25·7	30·0	28·0	35·0	31·3	31·7	28·1	27·5
Dry Gluten (per cent.)	8·6	10·1	9·4	10·9	10·3	9·8	9·3	8·7
Water absorption (Farinograph) (per cent.)	57·5	57·5	55·4	59·6	60·0	57·0	53·0	54·4
Valorimeter No. (Farinograph) ..	38	39	39	38	38	40	40	32
Maltose Figure (mgrms. Maltose per 10 gms)	142	110	108	107	111	93	80	90
Gassing Power (cc. per 100 grms. flour in 5 hours)	..	..	..	..	820	680	545	665

TABLE 3.—STANDARD BAKING TESTS (100 GRM. FLOUR)—LOAF VOLUME IN C.C.

Formula.	1942.	1943.	1944.	1945.	1946.	1947.	1948.	1949.
Basic	440	440	405	425	477	450	440	460
Basic + malt + phosphate	475	490	475	494	550	510	510	480
Basic + malt + phosphate + bromate..	460	505	515	592	555	540	555	465

LIVE STOCK NOTES

Compiled by A. C. T. HEWITT, M.Agr.Sc.,
Live Stock Science Officer

DR. PETERSEN DISCUSSES UDDER OF THE DAIRY COW

IN a talk given in the course of his recent visit to Victoria, Dr. W. E. Petersen, world-renowned authority on milking technique and dairy-cow physiology, described the cow's udder as a parasite on a host, and said that the cow would get along much better without it.

The udder is really a skin gland and, with modifications, is similar to combined sweat and sebaceous glands. At birth, the udders of both male and female calves are similar, but the production of female hormones causes the udder of the female to develop.

The presence of the milk veins which have little to do with milk secretion, are believed to indicate that at one time the udder of the cow was attached to the breast as occurs in some other mammals.

The udder is most important, said Dr. Petersen, and the size and shape of both udder and teats, and the feel of the udder when milked out, can be satisfactorily judged in the show ring. Good udders and teats have a direct bearing on the value of the cow as a dairy animal.

An udder with a level flow, and with no quartering, drains out best while being milked by machines. Pendulous udders are objectionable and liable to injury and subsequent attack by mastitis. The good udder is held compactly between the hind legs by ligaments and if these ligaments are weak the udder is likely to fall and become pendulous. Arteries enter the udder from amongst these ligaments and supply the food on which the parasitic udder grows and secretes milk.

In the young heifer, the development of the udder can be influenced by the injection of hormones, and many of the differences between udders are due to the amounts of the particular hormones secreted by the heifers themselves. By the injection of hormones the production of a cow has been increased by 60 per cent. over that of a previous lactation.

Some cows do not secrete sufficient let-down hormone. Usually, after calving, a cow produces sufficient hormone, and milks heavily. Production of the hormone then sometimes slows up and the cow lets down only about half of her milk. Such cows usually develop a fleshy upper portion to the udder and a soft lower portion and are noted for their large yields for about three months and then rapid drying off. They are not persistent producers. The injection of more hormone makes persistent and good producers of them, but one cannot be continually injecting hormones into them.

The size and shape of the teats is important, and until cows can be bred with teats of uniform spacing, shape and size, Dr. Petersen considers that it will be impossible to manufacture the ideal teat cups. At present, teat cups have to be designed to milk most cows fairly well, and at times they are badly suited to draw milk from the teats of some cows.

The size and shape of the udder and teats have no relationship with any other conformation point. A common belief that the general level of the floor of the udder is parallel with the level or slope of the rump is wrong. Cows with the worst rumps may have the best udders and vice versa.

Conformation of Little Value in Selecting Dairy Cattle

Dr. Petersen considers that, in addition to a thorough examination of the udder and teats, the only way to select cows is to get their records of production. It should not be forgotten that the good producer can be a "good looker" and the "poor looker" can be a good producer. To Dr. Petersen any good producing cow looks all right.

W. W. Swett of the Bureau of Dairy Industry of the United States Department of Agriculture, working at Beltsville Dairy Research Station obtained the skeletons of a life-time record-producing cow and a champion Aberdeen Angus cow, and the only anatomical difference between the two was that one of the cows was polled and the other horned. The skeletons were examined by expert judges, who were asked to indicate which skeleton came from the beef cow and which from the dairy cow, and approximately half of the expert judges were wrong in their selection.

The only differences in the external forms of dairy and beef cows are observable in their flesh conformation which is accounted for largely by hormone activity. When working on other anatomical features, it was found that the size of chest and spring of the rib bore no relationship to the size of the heart and lungs. It is commonly believed that a large chest and well-sprung ribs are an indication of a large, strong heart and better lung development.

A big barrel is generally regarded as an indication that the animal can eat and digest large quantities of roughage, but in one experiment it was found that two Jersey cows of poor type and lacking both heart-room and barrel-space, were able to consume considerably more lucerne hay, which was the only food given them, than the big-barrel cows, which indicated that it is the rate of fermentation and the activity of the gut which determines the amount of food that the animal can eat and digest and not the size of the body or other visible morphological features.

BREEDS OF DAIRY CATTLE

Victorian dairy cattle are descended from various European breeds, the more important of which are Jersey, Dairy Shorthorn, Ayrshire, Friesian, Guernsey, Red Poll, Hereford, and Shorthorn.

To a lesser extent Aberdeen Angus, Devon, South Devon, Kerry, Dexter Kerry, and Red Dane blood has been used, but the identity of the last-named four breeds has long been lost and the other breeds are being used less and less in the dairy industry. Little, if any, blood from Asiatic cattle like the zebu has ever been introduced into Victorian dairy stock.

Stud breeders regularly import stock to breed to the overseas standards, and have paid little attention to the development of Australian breeds as, for example, the wool growers have done with sheep and the poultry breeders with poultry.

The development of the British breeds of dairy cattle was discussed in these notes in our January issue.

Dairy Shorthorns

The Dairy Shorthorn is a selection of the Shorthorn, one of the principal British beef breeds. The Shorthorn was developed in the latter quarter of the eighteenth century in the Tees River district in the north-east of England, where superior British cows had been crossed with bulls from Holland and Denmark. Selections made by such men as the Collings Bros., Thomas Booth, and Thomas Bates were largely responsible for the Shorthorn as it is known to-day.

The Dairy Shorthorn (registered in Coates's Herd Book) was formed in 1905 and the chairman at the inaugural meeting explained that, "It was necessary that something should be done to maintain the position of the Shorthorn as a dairy cow. The farmer required an animal which would yield a large amount of milk and which was

capable at the same time of carrying flesh; the Dairy Shorthorn was the ideal animal for the purpose. The association would, by offering prizes for Dairy Shorthorns, and by recommending judges, do their best to sustain and popularize for the dairy the Shorthorn—a breed for many years justly famous for beef."

The Dairy Shorthorn breeders accept Shorthorns registered in Coates's Herd Book into their register.

The ideal Dairy Shorthorn is a dual-purpose animal capable of producing large quantities of milk and when dry evenly covering her frame with flesh to make a good beef cow. The steers can also be fattened into good beef. Mature cows weigh over 1,200 lb.

In Australia, the Dairy Shorthorn Association registers cattle by a method similar to that used for registration in Coates's Herd Book. The Australian Herd Book numbers for cattle that would be eligible for Coates's Herd Book are followed by the letter "A." The different grades range from "A" down to "F," but unless an "A" grade bull is used, progeny will revert to "F" grade. The progeny of an "A" grade bull may be lifted one grade higher than their dams.

COMPETITION AND EDUCATION FOR PIG RAISERS

The Australian Meat Board's Victorian Bacon Pig Carcass Competition will be held in Melbourne during the first week in May. Entries for the pig carcass competition close on the 14th April and entry forms and full particulars of conditions and the prize list are obtainable from the State Representative of the Australian Meat Board, 401 Collins-street, Melbourne. The competition is open to all pig breeders.

The competition bacon pigs will be on exhibition at the Melbourne Showgrounds from 2 to 5 p.m. on Tuesday, the 3rd May. Particulars of this competition were discussed in this Journal last December.

While the pigs are being slaughtered and their carcasses chilled and judged on Wednesday and Thursday, visitors and exhibitors will be provided with practical demonstrations, addresses and moving pictures at the Showgrounds. The programme is as follows:—

TUESDAY, 3RD MAY

2–5 p.m. .. Public inspection of Competition and stud pigs in the Pig Pavilion at the Showgrounds, Ascot Vale.

WEDNESDAY, 4TH MAY.

10 a.m. .. Sale of stud pigs.

1 p.m. .. Judging demonstrations on live pigs by—
(*a*) a stud pig breeder and judge;
(*b*) a pork and bacon pig buyer;
(*c*) the Victorian Government Pig Expert.

3 p.m. .. Moving picture programme on rural topics by Victorian Department of Agriculture.

THURSDAY, 5TH MAY.

10 a.m. .. Addresses and open discussion led by the President and Committee members of the Australian Pig Society (Victorian Branch) on "Problems of The Pig Industry".

11.30 a.m. .. Address by Mr. R. J. de C. Talbot, Superintendent of Live Stock and Chief Veterinary Inspector, Victorian Department of Agriculture, on "Health Aspects of The Pig Industry".

1.30–3.30 p.m. .. Demonstration by Mr. J. Reynolds, Commonwealth Veterinary Meat Inspector and Grader on inspection and grading of pig carcasses for export.

FRIDAY, 6TH MAY.

10 a.m. to 12 noon Exhibition of the cut carcasses of the competition pigs in the Sheep Pavilion, with commentary by the judge and the Department's pig expert.

Addresses and presentation of prizes by the Minister of Agriculture and the Chairman of the Australian Meat Board.

Luncheon will be available at the Showgrounds at 12 noon each day.

POULTRY BREEDING METHODS

Flock mating is extensively practised by commercial poultry farmers in Victoria. Although the method has given fairly satisfactory results, the general quality of flocks varies considerably from year to year, the percentage of fertility, hatchability, egg production and mortality fluctuating considerably.

Variations in quality, &c., can be expected in any method of breeding, but they are more marked in some than others. The quality of a flock is a reflection of the owner's knowledge and capacity for work. Where flock mating is practised, the birds should be rigidly culled, and only the highest-quality fowls retained.

The breeding stock should be as near to perfection as hand selection will permit. They should conform to the standard of the breed in conformation and size. It is a mistake to increase the size of birds beyond the weight requirements of the breeds. It is also unwise to breed from birds below standard weight.

Some authorities claim that birds consume approximately 1 oz. of food per pound of bodyweight per day, but seeing that appetites vary, this theory cannot be wholly accepted. A large animal usually consumes more food than a smaller one, so it would be better to breed White Leghorns weighing 4½ to 5½ lb. rather than 7 lb.

Commercial poultry farmers find it impracticable to carry out single-testing or trapnesting owing to the great amount of labour involved, and this also applies to progeny testing, yet the farmer who is striving to improve and maintain a high quality flock must inaugurate some method whereby improved results may be obtained. The logical answer is progeny testing, even if conducted on a small scale, as it is the most reliable method of testing the value of male birds for breeding purposes.

The value of proven sires cannot be overestimated as they can usually be relied upon for the production of high-class stock.

Most commercial poultry farmers utilize their laying sheds for breeding purposes, where 80 to 100 hens are placed in pens measuring 20 ft. x 20 ft. and mated to a number of male birds, but special breeding pens are required for progeny testing in order to keep each mating separate. Consideration should be given to this aspect by those who intend to commence poultry farming. The inclusion of a group of breeding pens each measuring approximately 12 ft. x 10 ft. to provide sufficient accommodation for 15 to 20 hens mated to one male bird, is most desirable.

[M. D. HALL—Poultry Expert.

NORTHERN DISTRICT WHEAT CROP CHAMPIONSHIP—*(Continued from page 156)*

LIST OF WINNERS.

The winners of the Northern District Championship since the inception of the competition are as follows:—

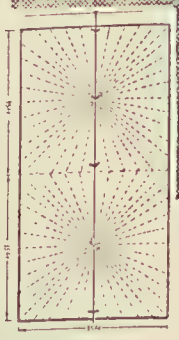
Year.	Winner.	Agricultural Society.	Variety.	Certified Yield.
1946 ..	T. Klemm, Londrigan ..	Wangaratta	Magnet ..	50·2
1947 ..	J. Dunne, Springhurst ..	Wangaratta	Magnet ..	39·8
1948 ..	R. W. Thomas, Dookie ..	Dookie	Baldmin ..	63·7

NORTHERN DISTRICT CHAMPIONSHIP ENTRIES, 1949

Name.	Address.	Agricultural Society.	Variety.
R. W. Thomas	Dookie	Dookie	Baldmin 1st
P. F. Sims	Springhurst	Wangaratta	Magnet 2nd
J. Thomas	Mulwala	Yarrawonga	Quadrat
H. Henderson	Barraport	Boort	Insignia
K. Gillespie	Youanmite	Nurmurkah	Quadrat
G. Pearce	Rutherglen	Rutherglen	Baldmin
R. Kaye and Sons	Baringhup	Maryborough	Quadrat

NOT ONE CROP FAILURE

IN OVER 20 YEARS



The "Webb-Way" Sprays Square

That is the experience of a number of users who installed "Webb-Way" in early days—and the experience is the same each year with every user from the day they put in the first section. **Not One Crop Failure!** Imagine what that means to you. The loss incurred in one dry spell would more than pay for plant sufficient to cover your whole property. But you don't need to install it all at once. The profits earned by the installation of one section pay for the extension of the plant.

Cuts Costs in Half

The "Webb-Way" follows the contour of the land—the fall of rain is even—no dry patches—no over-lap or over-watering. It is as even on the hillside and on the top as at the first section on the creek-bank.

EXPERT ADVICE FREE AND WITHOUT OBLIGATION

Let us send you an expert to tell you exactly what is required—how little it will cost in either initial outlay or total commitment. We will do so gladly—at no cost or obligation to you.

Irrigate the "WEBB-WAY"

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SHELL
HORTICULTURAL PRODUCTS

Many years of highly scientific study and research both in the laboratory and in the field, have gone into the perfecting of Shell Spraying Oils and Grafting Mastics, which today are recognized all over Australia as the standard of quality, each for its particular job.

SHELL WHITESPRAY

A foliage or summer pre-emulsified spraying oil containing a highly refined oil for the control of red and other scale pests of Citrus ; Codling Moth and Light Brown Apple Moth ; (in combination with lead arsenate), Red Spider, Mites, &c., on Apples and Pears.

SHELL PALESPRAY

This is a pre-emulsified dormant spraying oil and is used for the same purpose as Redspray, but has additional advantages over the conventional type red spraying oils in that Palespray can be used in combination with bordeaux and lime sulphur and mixes readily in hard water.

Shell Palespray is the ideal dormant spray, and gives higher oil deposits on the tree, thus obtaining more efficient control of Red Mite, San Jose Scale, Woolly Aphid, &c., &c.

SHELL REDSPRAY

A miscible or soluble spray for use in the dormant season on Deciduous trees for the control of Red Mite, San Jose Scale, Woolly Aphid, &c., &c.

SHELLICIDE "D"

A semi-dormant pre-emulsified spraying oil containing a more highly refined oil than even pale or red spray, and can be used in combination with bordeaux or lime and sulphur up to the pink stage of Apples. Shellicide "D" acts both as a spreader and more particularly as a sticker, leading to more uniform and more permanent cover of the fungicide.

Shellicide "D" is the ideal "in-between seasons spray" and mixes readily in hard water.

SHELLESTONE

This is a plant hormone spray for the control of pre-harvest drop of Apples and Pears. Whilst preventing the premature drop of fruit Shellestone will not delay maturity.

SHELL APHIS OIL

A recently introduced but highly successful spray. Shell Aphis Oil is a product combining the insecticidal effects of D.D.T. and petroleum oil emulsions. It is specifically designed for use on Peaches, Cherries and Nectarines in the late dormant period, to control both Green and Black Peach Aphid and Black Cherry Aphid. It is a pre-emulsified concentrate and is miscible in hard water.

SHELL UNIVERSAL D.N.C. WINTERSPRAY

A dormant spraying oil which contains a potent organic insecticide—dinitrocresol—and is primarily designed for control of the tough over-wintering eggs of the Green Peach Aphid and Black Cherry Aphid, and also provides simultaneous control of San Jose Scale and Red Mite on Peaches and Cherries. This spray mixes readily in hard water, and does not burn the hands or face.

All available in 4-gallon tins or drums (according to availability of packages) and 44-gallon drums

The Shell Company of Australia Ltd. (Incorp. in Gt. Brit.)

THE GRAPE INDUSTRY IN CALIFORNIA

Observations made by Frank M. Read, M.Agr.Sc., Chief Inspector of Horticulture, during a visit last year to the United States of America

From an area of about 500,000 acres, California produces four-fifths of all grapes grown in the United States of America. Drying varieties occupy 250,000 acres and produce about 1,750,000 tons fresh weight. The corresponding figures for wine varieties are 170,000 acres and 535,000 tons; and for table grapes 80,000 acres and 600,000 tons. The wine varieties are used exclusively for wine or grape juice, but both the table and raisin grapes contribute substantially to wine and brandy making from the totals quoted above.

Mr. Read spent, in the aggregate, eight days in two visits during the period from the 1st October to 29th October in the San Joaquin Valley, mainly Fresno and Modesto, and, during that time, took the opportunity to observe vineyard work, including the harvesting of grapes for drying and the cleaning and packing of dried fruit, and also the packing and handling of fresh grapes for the United States market. Owing to the limited time at his disposal, he was unable to visit any wineries.

PRODUCTION OF GRAPES FOR DRYING

As in Australia, the principal drying varieties are Thompson Seedless, Muscat of Alexandria (Gordo) and Zante currant. The Thompson is very similar to the variety we know in Australia as the "sultana," though I formed the impression that our fruit is slightly longer and larger. The American "sultana" is an inferior drying grape grown to a very limited extent only, and not as similar to our sultana as is the Thompson Seedless.

A young vineyard at Fresno. The vines are planted at the foot of trellis posts. Each row has an irrigation valve rising from the concrete main below, and two small outlet pipes from each valve.

The vines are, of course, irrigated, some from gravitational water supplied through community schemes, but the bulk of the area relies upon water pumped by individual growers from deep bores on their properties. A typical well and plant might reach to 200 ft. and deliver 400 gallons a minute, using a 15 h.p. electric motor and turbine. The cost of such a well would be about £300 for the casing and something over £200 for the motor, &c.

Planting distances are similar to ours. For instance, Thompsons are planted 6, 7 or 8 ft. between the vines and 10, 11 or 12 ft. between the rows, while the Muscats were usually 8 ft. x 10 ft. apart. Trellising

Muscat (Gordo) vines at Fresno are grown as bushes.

is quite different from our method, each vine being planted at the foot of and trained to a stake of 3 in. x 3 in. timber about 2 ft. in the ground and 3 to 4 ft. out of the ground. The height of the trellis seems to vary appreciably. One wire only, placed at top of the post, is common, though a second wire a foot from the top is sometimes used in Thompsons and usually in Zante currants. Muscats are normally grown as bushes without trellis.

A sloping "T" trellis, which we have tried without much success in Australia, is sometimes used on Thompsons, though it is primarily for use in tall-growing table varieties, such as Emperor. It consists of a cross-piece fixed to the top of the trellis post and sloping at an angle of 30°. It is about 3 ft. long and rather more than half is above the post leaving about 15 inches sloping down from the top of the post. I do not think we have appreciated in Australia either the purpose of this form of trellis or the correct method of using it.

It is of most use where the rows run east and west, the top piece then sloping towards the south, that is, towards the sun (in Victorian districts it would slope towards the north). Shortly before the grapes commence to ripen, the foliage hanging from the back or northern side of the trellis is largely removed so that the bunches hang in full light, but protected from the direct sun. This causes white grapes to take on a creamy colour rather than a green, and greatly improves the quality of all grapes. The trellis in addition enables more fruiting wood to be carried without overcrowding and facilitates thinning, girdling and harvesting.

Between 10 and 15 per cent. of the grapes in the Fresno district are planted on resistant stock No. 1613 (Rupestris x Riparia) which is resistant to both Phylloxera and Root Knot nematode. Rupesta du Lot is said to have been the best of the resistant stocks of the early plantings, but "1613" is now universally preferred.

The resistant rootling is planted in the first year in spring, the trellis stakes being put in either previously or not later than autumn of the first year. The rootling is budded in autumn of the first year, the bud remaining dormant through the winter and shooting the following spring. If the bud fails to "take," the vine is whip-tongue grafted in the spring. The resulting growth in the second year is not used by the best growers to produce the stem, but is cut back in winter to one shoot and to two buds from the ground; the stem is made from the resulting growth. This gives stronger stems and greater uniformity.

A June (December in Australia) graft is growing popular as an alternative to the above procedure. An active scion of two to three buds is grafted on to the stock. A whip graft is used, that is, a straight cut of 45° across stock and scion without a tongue. The graft is tied with a rubber strip.

Zinc deficiency of vines is frequently present, even where there are no symptoms in the foliage. It produces long, badly-set bunches and treatment with zinc has caused increases in yield of 25 to 75 per cent. in Muscats and rather less in Zante currants. The treatment consists in daubing the pruning cut with a solution of zinc sulphate 1½ lb. to 2 lb. per gallon.

No benefits have yet been proved in Thompsons, possibly because cane pruning has prevented adequate absorption of zinc. The currants and Muscats are spur pruned. In 1949 it is proposed to try a winter spray

of zinc on Thompsons after pruning to see if absorption is possible through the bud base.

The fertilizer programme favored by the Extension Service is the application of nitrogen equivalent to, and preferably in the form of sulphate of ammonia, 400–500 lb. per acre. The use of commercial, mixed fertilizers is not favored by the Extension Service.

A green crop of tick beans and field peas put in with superphosphate in the autumn is considered good practice. The ploughing under of the green crop in spring and clean cultivation throughout the summer, as in Australia, appears to be standard practice, but at Modesto I saw an area of White Malaga vines which had not been cultivated in any way for four seasons, the growth of weeds being prevented by the use of oil sprays. These, by comparison with vines receiving standard treatment, showed no observable differences in appearance or yield.

Pierce's disease of vines is a virus disease now quite widespread in California, though usually only a few odd vines are affected and removed. Prior to an understanding of its virus character and identification of the vector, a leaf-hopper which transmits the disease (lucerne dwarf) from lucerne to the vines, did very extensive damage. It is a phloem disease in some respects similar to bud-union decline of citrus. It causes delayed foliation and dwarfing of the vine, mottling and, later in the summer, burning and drying of the leaves with wilting and drying of the fruit. The canes do not mature evenly in autumn and in the second year the vines usually die. The possibility of Pierce's disease being responsible for the death of vines in a rather similar way in Murray Valley districts of Victoria should be considered.

Black Measles is another disease thought to be virus in character producing dark spots in the berries and chlorosis of the leaves. The chlorotic patches cross the veins as distinct from Pierce's disease. Sometimes the leaf symptoms are not seen, even where fruit symptoms occur. Vines do not show symptoms every year but rather spasmodically. Spraying with sodium arsenite 4 lb. As_2O_3 per hundred gallons is recommended for the whole vineyard in which any diseased vines are noticed.

Grape Mosaic and another unnamed virus disease, which causes the leaves to have veins in a fan-shaped pattern, were also pointed out to me.

Extension officers told me that a yield of 2 tons of dried Thompsons per acre would be good, but that on the best soil type, Fresno fine sandy loam, a good crop might be expected to yield 3 tons.

HARVESTING AND DRYING VINE FRUITS

Since 1930, a continuous study has been made of the influence of temperature from blossoming time onwards on the rate of development of the grape and the date of reaching maturity. The number of " degree days " from blossoming to maturity for table grape and for raisin harvesting is now known for all varieties, and it is apparently of value in California to be able to forecast, as soon as possible, the probable date of harvest.

In the canned fruit industry particularly, and in other fruit industries, the same method of estimating the date on which harvest will commence is used. Such studies are not unknown in Australia, but they are not used here to anything like the same practical extent. I formed the opinion that when data has been collected over a sufficient period of years, this method of forecasting is very reliable.

The Thompson seedless grape at Fresno.

The wooden tray is seldom used now, having been replaced by paper trays of the same size (see illustrations on facing page).

The bunches, when ripe, are cut and placed in a single layer on " trays " at the foot of the vine on the sunny side, that is, south of the east-west rows. The " trays " were originally of light timber, but are now simply sheets of brown paper 3 ft. x 2 ft. When the grapes are sufficiently dry on the upper side, they are skilfully turned by hand with the aid of a spare tray so that, without disturbing the bunches, the underside is then exposed to the sun.

This work is mainly done by teams of Mexicans at a contract price of £2 3s. per thousand trays. Harvesting last year, I was told, had commenced about September 10th and the fruit was dry on the trays early in October.

The next process is to roll the paper "trays" up. Usually the ends are tucked in, but sometimes they are left open—cigarette rolls—so that the air can still pass through.

The bundles are left at the foot of the vine for a few more days to even up the moisture of the berries, and they are then picked up and the fruit emptied into sweat boxes to be stored in a central place on the vineyard until taken to the packing house.

In handling the sweat boxes at this central point, that is, moving them from the lorry into the stack, an electric hoist was frequently used and should appeal to many Victorian growers. It consisted of a cross-beam spanning the proposed stack of sweats with two legs at either end. Working on the cross beam was a small electric motor and block and tackle. The whole outfit was mounted on wheels, electricity being conveyed by a long flex from the power point.

The fruit in the sweats seemed to me a little moister, at all events on the surface, than might be expected in Victoria, but the grower's full price, approximately £41 10s. a ton, is paid only for fruit below 17 per cent. moisture on delivery at the packing house.

Even allowing for the fact that the fruit, as delivered, contains the bunch stems, the price paid to growers is roughly of the order of returns in Australia and does not appear to be sufficiently high to offset the very high costs of labour in America. The standard wage of an orchard hand seems to be about £16 per week with higher payments for specially skilled hands. I was told that the price of vineyards in the war years was up to £1,400 per acre, but is now around £450. There is a considerable movement out of dried fruits into cotton in California at the moment because of the relatively lower net returns from dried fruit than from other crops and fear of over-production.

It will be gathered from the description of the above practices that the climate at Fresno must be extremely reliable, although, during my visit, there was a scare that rain might occur before the fruit was brought in from the " trays ". Happily, rain did not fall.

DEHYDRATION OF THOMPSON SEEDLESS CROPS

A small part of the crop, up to 20,000 tons, is not field dried, but is dehydrated to produce a light golden or " bleached " berry. This is not popular with buyers in the United States who prefer the dark-brown color and full flavor of their sun-dried fruit, but until late years it found a market in Great Britain and Europe. Recent press statements that special arrangements have been made between the United States and

British Governments for the purchase of dried vine fruit might, I think, be concerned partly with the Americans' inability, when I was there, to sell this "bleached" product easily.

Thompsons for dehydration are left longer on the vine until they are yellow green. When harvested, they are dipped in a manner similar to our fruit, but always in hot caustic soda up to 1½ per cent. at temperatures varying from 190° F. to 205° F. Fruit from the dip is spread on to wooden trays 6 ft. x 3 ft. and after a short draining these go into a sulphur chamber 6 ft. x 8 ft. x 10 ft. high for three to four hours. Up to 12 lb. of sulphur is burnt in the chamber in this time. It is burnt in a tray which is pushed into a 9 inch pipe running beneath the floor of the sulphur chamber and open at the rear end.

From the sulphur chamber the fruit passes to the tunnel dehydrator. Officers of the United States Department of Agriculture told me that a commencing temperature of 160° F. to a finishing temperature of 130° F. is recommended for a dehydration period of up to thirty-six hours, but in two tunnels I saw at Fresno and Modesto temperatures of 155° F. and 160° F., respectively, were being aimed at throughout the length of the tunnel for the whole drying period, the inlet doors of the tunnel being left open throughout drying and air at these temperatures simply being blown through by a fan from a fuel-oil heater at the remote end.

The time taken to dry the fruit I saw was eighteen to twenty-four hours. A final pack of 18 per cent. moisture is permitted.

CLEANING AND PACKING

Through the courtesy of the Sun Maid Co-operative Co., which packs up to 150,000 tons a year out of the total annual production of about 275,000 tons a year, I was able to see something of the methods of handling fruit at the packing house.

Sampling and Grading

When fruit is delivered by a grower the load is inspected and if it is not, in the opinion of the packing house, too high in moisture content and is in reasonable condition, it is accepted. No grade is given at this time.

As the box goes down the gravity conveyor from the load, a man digs and grabs a handful from the middle of each box, taking

The usual paper "tray" 3 feet by 2 feet on which fruit is dried at the foot of the vine.

Typical row of Thompson Seedless grapes drying on trays.

Thompson Seedless grapes curing in bundles after drying on paper trays in which they are now wrapped.

GRAPE GROWING in

Laying an irrigation line before establishing a vineyard. The outlet valves on the bank will be cemented into the line.

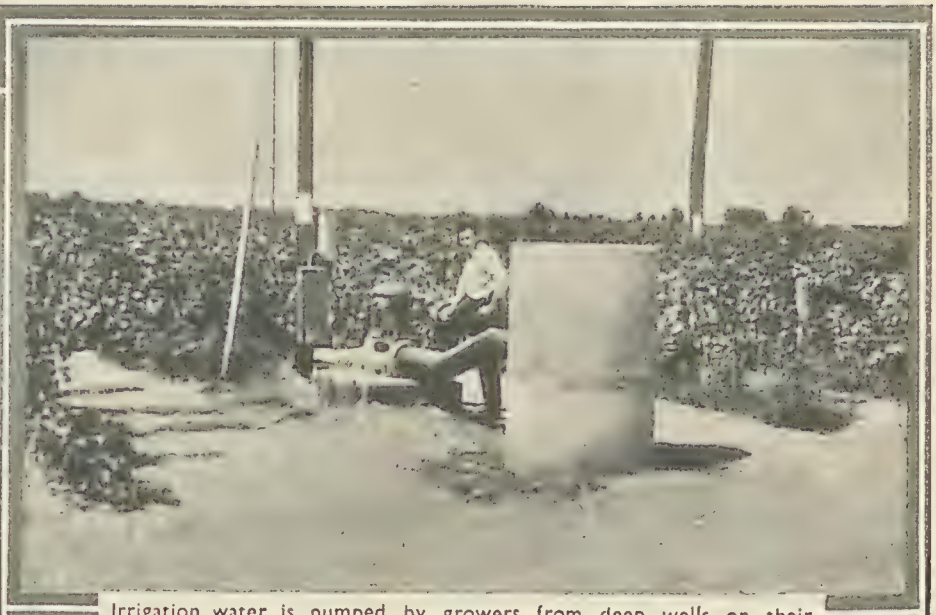
Pierce's disease of grape vines is a virus collapse of foliage, and, in the second year, pr

The gene

A typical home of a dried-grape grower near Fresno.

ALIFORNIA

auses the sudden
death of the vine.



Irrigation water is pumped by growers from deep wells on their properties. The bore lining carried above the surface gives a head of five feet.

at Fresno is very similar to Mildura.

An electric hoist for moving sweat boxes from lorry to stack.

sufficient from each box to fill a bushel box for each load. This bushel box contains big stems, small stems and berries in what is considered the same proportion as in the load. This sample box is taken to a small cleaner where it is put through a drum and a shaker grader.

There is no attempt made to measure the proportion of stems, &c., as it is assumed that all loads are roughly the same, and the main test on which the grower is paid is a *weight per volume test* on the screened fruit. A small can like a three- to four-gallon milk-can is given a standard rocking motion while being filled in a standard time with the screened fruit.

When the can is full, it is weighed and a price per ton paid in accordance with a scale of weights. The weight depends on the sugar content of the fruit and its plumpness. Sugar is heavier than water. The sample is then put back into the box and kept a reasonable time until there is no likelihood of dispute as to price.

The moisture content of every sample is not determined; but if the grader thinks the fruit is over 17 per cent. he puts it through a test which is preferred to the resistance-box method of testing and has been in operation much longer at the Sun Maid Co-operative Co. than the electric resistance method. This test may be described in general terms as follows:—

1. A tin about the size of a cocoa tin is filled by hand with fruit dropped in lightly, ten to twenty berries at a time, as taken from the bushel sample box at random.

2. The tin, when full, is shaken lightly for a second and its temperature is taken by inserting an ordinary thermometer. The fruit is then poured into a standard brass cylinder which is placed under a plunger which exactly fits the cylinder. The plunger is brought just to the surface of the fruit and clamped in this position. It has a vertical shaft to which is attached a horizontal pointer and a platform on which a standard weight can be placed.

3. When the plunger is unclamped it tends to fall, compressing the fruit, and the amount by which it falls is shown by the pointer on a scale to the right of the machine. On this scale adjustments can be made for the temperature of the fruit at the time the test is carried out, because the compressibility of the fruit depends on the temperature and on the moisture content. The warmer and wetter it is the easier will it compress.

The weighted plunger is allowed to compress the fruit for exactly fifteen seconds, when it is again clamped and the pointer is read. The accuracy of the test, of course, depends on the accuracy of the scale, and this was said to be the result of six months' intensive research during which the machine was tested against accurate laboratory tests for moisture and the scale adjusted accordingly until full reliability was obtained.

4. If the fruit shows more than 17 per cent. moisture, a deduction in price of £3 per ton is made for each 1 per cent. of moisture above 16 per cent. and a deduction of weight is also made. A charge is made for the dehydration of fruit, where necessary, irrespective of the former deductions. I was informed that the system works without friction and that growers rarely question the fairness or accuracy of this method of assessing value.

Cleaning Includes Washing

Two things, particularly, struck me about the cleaning of Californian dried fruit.

Firstly, there is a complete absence of dust in the cleaning house, even though, as stated earlier, the crop is simply dried on sheets of paper on the surface of the ground. The vineyard soil when I walked over it was often so powdery that one sank to the ankles in fine dust.

Secondly, the fruit is washed during the cleaning process before packing and is in no need of any further washing to make it thoroughly suitable for eating out of the packet or for domestic use in cooking.

The following sequence of operations is included in cleaning:—

1. The fruit, as delivered, goes first to the big stemmer where it travels down the inside of a sloping revolving drum about 3 feet in diameter and on to a shaking riddle. This removes the fruit from the big stems.

2. The next unit is the cap stemmer to remove small stems and fruit stalks. This is a fast revolving smaller drum about 18 inches in diameter.

3. The fruit is then in an enclosed chute elevated to the floor above where it is dropped through the blast from a large fan

from 6 feet to 8 feet in diameter. This winnows out the dust, small stalks and very small or light berries. The debris is blown along a chute outside the building to a dust arrester.

4. The winnowed berries are taken on a belt (belts are concave, being run on a set of three rollers of which the outer two slope up) to the fruit washer which is a conveyor about 10 feet in length and about a 30° downward slope with cups to hold the fruit as it is delivered from a hopper at the top. While the fruit is travelling down this fast moving conveyor water is pouring over it and through it. The water falls through the washer to be caught below and pumped up to be used again, except a percentage which is discarded from the bottom to remove the dirt.

A percentage of new water is taken in all the time but the water used was not clear, though quite clean enough for the job. The duration of this washing process would be about three to four seconds.

5. The washed berries are conveyed to and passed through a double drum running at a high speed which throws out moisture by centrifugal force, but moisture is still perceptible on the surface of the fruit which is then ready for sorting and packing. I was surprised to find that the fruit is not further dried and that fruit which is dry enough when received to be properly cap stemmed will not take up too much water in washing to cause any problem in packing.

Australian sultanas and raisins which are dipped may not behave in exactly the same way as Californian fruit, which is sun-dried without dipping, but I was pleased to see that even the dehydrated or bleached fruit which has passed through a hot caustic soda dip is cleaned in exactly the same fashion as the undipped sun-dried Thompsons.

We should, therefore, in Victoria this season, carry out similar washing tests to see whether drying of our fruit before packing would be necessary. Even if some drying proves to be necessary I consider a move towards general washing of Australian fruit to be in the industry's interest. I heard while in California that Mediterranean producers are looking for fruit-washing machinery in the United States.

6. The fruit is then run on belts past girls who give it a hand-sorting. Not much fruit comes out in this process, the fruit running pretty fast past them and in quite a thick layer. It then is travelled on the belt to an adjoining building for packing into boxes or cartons. It is packed either natural or oiled.

The bulk of the Thompson seedless is sold in its natural state, but carton Thompson fruit, which is always of the highest grade, all of the seeded raisins, and some other fruit, if ordered, are oiled. The only oil permitted to be used by the Pure Foods Regulations is that obtained from grape seeds coming from the deseeding machines. Previously, mineral oils were used, but they have been declared adulterants and their use prevented. Oiled fruit I have kept for some months, however, shows some rancidity.

7. During its run from the cleaning building to the packing building, each belt passes under a huge electro magnet placed about 2 inches above the fruit.

8. Grading is on size and not on colour. All the sun-dried fruit is dark-brown except the yellow berries which the bees have robbed. There is only one size grading which occurs in the original cleaning operations.

Vines at Shell Research Station, Modesto, uncultivated for four years and growing well. Weedicides keep the irrigation furrows and surface free of weeds.

Portable apparatus for fumigating dried fruit in special rooms after packing.

Packing

I was shown through the packing rooms of the Sun Maid Co. at Fresno where fruit was being packed into 30-lb. boxes and cartons containing 2 lb., 15 oz., and 2 oz.; 2-lb. cellophane packets were also being put up. I purchased and posted home samples of the different types of fruit for the information of people interested in the industry.

Practically the whole of the packing operations are mechanized. For instance, in the case of the 2-lb. packets the cartons are automatically fed into the machine, the fruit is automatically weighed, the carton is automatically filled with fruit and the tops and bottoms are then automatically folded and glued. A similar operation occurs in the cases of the 30-lb. box and the 2-oz. carton. The cellophane packets, however, were all weighed and filled by hand. They were pressed by machine but the top was folded over and glued by hand.

Ethyl formate 6 ccs. in a 30-lb. box is used, and in addition to this the boxes are fumigated with methyl bromide immediately after packing or, at all events, before storage or despatch. The fumigation rooms hold 1,800 30-lb. boxes and 3½ lb. of methyl bromide in summer (4½ lb. in winter) is used in the room, the fumigation period being twelve hours. It is also customary to fumigate the loaded rail cars with methyl bromide. A special outfit for injecting the fumigant into the chamber is used, the one I saw being supplied by the Dow Chemical Co.

I noted "non-slip" conveyor belts of treaded rubber over the metal rollers to control the movement of boxes down sloping conveyors. I was also interested in the speed belt which moves boxes, when packed, to the fumigation rooms in a steady stream at the rate of 10 feet per second.

Every case, carton and package is stamped with a distinguishing number for each day's pack so that complaints can be traced back.

The output of the Sun Maid Co. is 360 tons of packed fruit per day.

Other Packing Houses

I was told that the Sun Maid Co. had manufactured most of its own machinery, but most of the other smaller packing houses near Fresno use machinery supplied by the Food Machinery Corporation of San Jose through one of the F.M.C. Associated Companies—the Elliott Manufacturing Co., Fresno.

The Central Californian Packing Co. at Delray has a small plant with an output of 10 tons per day. At the time of my visit, Thompsons which had been dipped in hot caustic dip before dehydration were being treated satisfactorily. The Delray Packing Co., Delray, which I saw the same afternoon, has a higher capacity, 100 tons per day. The principle of cleaning, however, is the same in both houses, and, in many respects, similar to that at the Sun Maid Co.

Once again, the complete absence of dust in the houses, due to the fine spraying of fruit with water almost the whole way along the cleaning line and the washing without drying of the fruit were notable. Details of these plants can be obtained from the general export catalogue of the Food Machinery Corporation.

The Austral Otis Engineering Co. Ltd. of Hanna-street, South Melbourne, represents the Food Machinery Corporation in Australia, and has extensive interests in the canning industry, but, to date, it has not ventured into the dried fruits field. I have asked

(continued on page 174).

Dookie and Longerenong Agricultural Colleges

FINAL EXAMINATION RESULTS, 1949

DOOKIE COLLEGE

EXAMINATION RESULTS IN ORDER OF MERIT

Dux of College—Gold Medallist—C. N. Forster.

Diplomas in Agriculture

With Honours, Class I.—C. N. Forster, J. H. Murray.

With Honours, Class II.—J. B. Stuckey, J. T. Green, P. W. Webb, J. Brockwell, N. W. Sims, F. R. Fogarty, J. M. Ridgway, W. H. Mason, G. J. Wright, R. G. Kellock, J. C. Banfield, R. J. Evans and J. T. Houghton and E. J. Spring, aeq., G. R. Shady, W. B. Patterson, G. J. Rankin, J. M. Mill, G. J. R. Coles.

Pass.—C. H. Chapman, A. D. Slocombe, J. T. S. Dennis, S. R. P. Rand, G. N. Guyatt, K. Chester and A. R. Glasson, aeq., G. M. Cox, G. Sheel, G. Moreland, W. H. T. Barrow, D. W. Macaulay.

Passed at Supplementary Examination.—B. T. Dowling.

Granted Supplementary Examination.—C. C. Greenwood, G. R. Morten.

SECOND YEAR.

Pass.—J. M. Gillson, D. Gordon, L. G. Lomas, S. J. Webb, K. A. Boundy, R. L. G. Croxford, J. W. Disher, C. M. Daniell, D. C. Parker, B. T. Greenwood, W. D. Sawyer, B. D. Dixon, L. A. Docker, A. S. Neilson, R. W. McDonald, W. G. N. Young, P. G. Ryan, R. F. Akers, D. W. Norman, H. W. Bannister, and V. E. Wasilewsky, aeq., C. D. Nicolson, P. M. Home, Jean E. Levick, G. L. Simpson, B. R. Ellis, V. G. A. Stafford, B. L. Birch, G. McL. Speirs, K. F. X. Mulcahy, I. N. McDonald, J. R. Comley.

Granted Supplementary Examination.—J. J. Coates, J. D. Tipping, B. V. Ricker, H. W. B. Goodger, B. D. Crellin, M. G. Smith, J. W. Moorman.

FIRST YEAR.

Pass.—I. J. Grieve, A. K. Meaden, G. S. Fyfe, H. W. Little, D. B. Blackett, R. G. Lacey, M. M. Abbasi, K. M. Sheehan, D. W. Abbot, I. G. Monteath, V. K. Baragwanath, J. L. Parker, E. P. Shugg, L. T. Grenda, R. D. R. Scott, D. A. Barry, H. C. F. Harkin, G. R. Bell, J. C. Hall.

Granted Supplementary Examination.—M. I. Smith, U. B. Eyles, R. J. Middleton, G. Harvey, M. D. Abbasi.

University (SECOND YEAR, B.Ag.Sc.), *in alphabetical order.*

Pass.—D. Berry, Elizabeth A. Burnet, I. H. Cameron, P. M. Dexter, I. McL. Eadie, D. H. Elvery, J. Fisher-Pollard, Diana O. S. Grice, P. G. Hyland, J. K. Kehoe, R. E. Loder, F. M. Martin, J. B. McPherson, B. W. Muirden, B. M. Nicholson, W. B. Osborne, J. L. Patten, C. T. Patton, W. R. Rothols, J. N. Rowan, R. S. G. Summons, W. B. Tudor, N. L. Tyshing, Margaret Webb-Ware.

Result Deferred in one Subject.—W. C. Stanhope.

PRIZE LIST

THIRD YEAR.

Presentation Volume to Captain of College.—P. W. Webb.

Dux of College and Gold Medallist.—C. N. Forster.

Second Aggregate.—J. H. Murray.

First in Practical Work.—R. G. Kellock.

Farm Records.—R. G. Kellock.

SECOND YEAR.

First in Class.—J. M. Gillson.

Second Aggregate.—D. Gordon.

First in Practical Work.—P. G. Ryan.

FIRST YEAR.

First in Class.—I. J. Grieve.

Second Aggregate.—A. K. Meaden.

First in Practical Work.—H. W. Little.

SPECIAL PRIZES.

Project—awarded by Dookie and Longerenong Old Collegians' Association.—J. H. Murray and G. J. R. Coles, aeq.

Plant Diseases Collection.—J. H. Murray.

Botanical Collection.—R. L. G. Croxford.

Insect Collection.—A. K. Meaden.

Saddlery.—First, G. J. Wright; Second, Margaret Webb-Ware; Third, G. J. R. Coles.

Best Kept Room.—G. L. Simpson.

First in Agriculture III.—J. H. Murray.

Second Aggregate.—E. J. Spring.

LONGERENONG COLLEGE

EXAMINATION RESULTS IN ORDER OF MERIT

Dux of College—Gold Medallist—Winner of Fink Scholarship.—E. E. Belcher.

Passed Second Year.—E. E. Belcher, R. McL. Bigwood, J. A. Evans, F. A. Homburg, S. J. Finn, L. B. Farmer. T. C. Stannus, J. N. Plunkett, A. E. Ballard, M. F, O'Connor, R. D. V. Hill, D. J. Dowling, D. H. Settle.

Awarded Certificates.—E. E. Belcher, D. J. Dowling, F. A. Homburg, D. H. Settle.

Entitled to Supplementary Examinations.—A. P. Gross, I. S. Smith, A. L. Bodycomb, R. S. Lawrence, H. H. Simpfendorfer.

Dux of First Year.—R. J. Young.

Passed First Year.—R. J. Young, R. G. Grey, D. J. Reardon, D. Molyneux, G. A. Olorenshaw, J. W. Eales, G. S Whitely, T. D. Hassall, M. A. Plunkett, J. A. Ingram, J. W. Ford, N. C. Polkinghorne, J. R. Cornall, A. J. Heslop, D. H. Bilton, M. H. M. Belfield, B. B. Nicholls, D. McH. Brown, J. G. Britton, H. N. Fraser.

Entitled to Supplementary Examinations.—J. W. B. Oldfield, W. M. Grant, S. C. Dass, B. P. O. Rogerson, G. N. Roberts, T. H. Trewin, P. G. Forbes, I. J. Mackay, D. R. Lewis.

Presentation Volume to School Captain.—R. McL. Bigwood.

H. R. Pierce Memorial Cup (Blacksmithing and Farm Machinery).—E. E. Belcher.

Bell Shield.—Sinclair House (average 80·8).
Bell House (average 80·1).

Agricultural Aggregate (Group A and Prac. Ag.).—T. C. Stannus.

Practical Work (Seniors).—A. P. Gross.

Practical Work (Juniors).—R. G. Grey.

Dairy Aggregate (Seniors).—F. A. Homburg.

Dairy Aggregate (Juniors).—R. J. Young.

THE GRAPE INDUSTRY IN CALIFORNIA—*(continued from page 172)*

the Austral Otis Co. to obtain from Food Machinery Corporation blue prints of the recleaning (washing) unit with a view to estimating what such a unit would cost to make in Melbourne. While there is no guarantee that the methods used in California will be directly applicable in this country, I feel that the dried fruits industry should make trial of the fruit washing technique, particularly.

RAISIN PRICE SUPPORT PROGRAMME

A sharp decline in the market value of Californian grapes during the 1947 season was a serious blow to growers, and many growers are said to have suffered serious loss by selling at £34 per sweat-box ton, or less. However, there was hardly any carry-over of raisins from the 1947 season and the industry contended that the position is sound for 1948, but that to ensure against the lack of confidence which so depressed the 1947 market and reduced potential sales on the home market by an estimated 20,000 tons, the Government should adopt a "Price Support Programme" similar in principle to that of the 1941 programme and guarantee to purchase the whole of any unsold raisins from the 1948 crop at £43 per ton for sun-dried fruit.

I have a copy of the statement made by the Chairman of the California Raisin Working Committee at a Conference with Officials of the United States Department of Agriculture in Washington, D.C., 26th July, 1948. This statement sets out broadly the estimated production and channels of disposal through dried fruit, wine and fresh grapes for the 1948 season.

The second portion of this report, dealing with the production of table grapes in California, will appear in a subsequent issue of the *Journal*.

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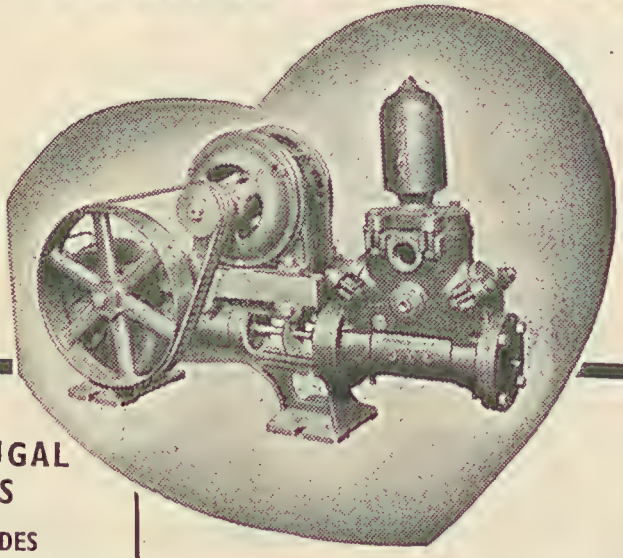

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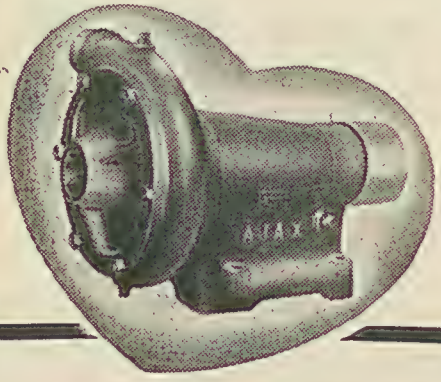

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Burnley Egg-Laying Competition

Final Results, 1948-49

By M. D. Hall, Poultry Expert

THE thirty-eighth egg-laying competition for fowls, conducted at the School of Primary Agriculture and Horticulture, Burnley, commenced on the 1st April, 1948, and concluded on 2nd March, 1949, a period of 48 weeks.

In this competition the best performance was that of a White Leghorn entered in the wet-mash class by Mr. H. E. Hill. This bird laid 304 first-grade eggs, the highest score in all classes of the competition. This competitor was also awarded the Burnley Champion Sash.

This White Leghorn owned by Mr. H. E. Hill, North Wonthaggi, gained the Burnley Championship this year with a total of 304 first-grade eggs.

Mr. L. Abikhair's White Leghorn which gained second place in Class 1 with a score of 296 first-grade eggs, was awarded Second Prize and the Burnley Sash. Third prize in this class went to Gibbs' Highway Stud for a bird which also gained the Burnley Sash. The birds in Class 1 displayed outstanding merit, not only for the excellent performance of the three prize-winners, but also for the large number of birds which obtained first-class Certificates of Merit.

Mr. G. Moran obtained first prize in the dry-mash class, with a bird that laid 280 first-grade eggs, and Mr. S. H. Hanson's Australorp was successful in the section for Australorps with a score of 269 first-grade eggs.

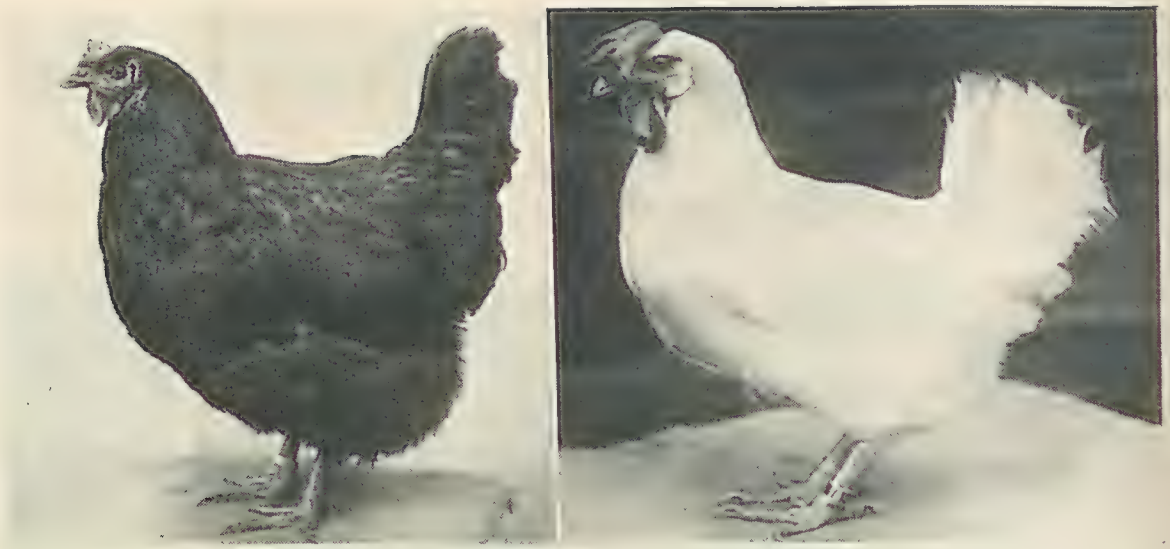
A good performance was recorded by a Legbar owned by "Glenyuille" Stud (H. D. Stewart). This bird laid 240 first-grade eggs.

First prize in the Rhode Island Red class was won by Mr. J. J. Mills with a bird laying 237 first-grade eggs.

Two competitors worthy of special mention are Mr. G. Moran, who obtained first and second prizes with his two birds in Class 2, and Mr. A. G. Beswick whose birds gained Second and Third Prizes in Class 4.

The mortality among the competing birds was low—3·8 per cent.

In the competition, prize certificates and sashes were awarded the owners of birds laying the greatest number of first-grade eggs. During the first two months of the competition, a first-grade egg must weigh not less than $1\frac{3}{4}$ oz. and thereafter not less than 2 oz. At Burnley, every egg is weighed to one-tenth of an ounce. The records are available for examination by any competitor.



Left: Mr. S. H. Hanson's Australorp which won the Wet Mash Section for Australorps with a total of 269 first-grade eggs. Right: Winner of the Dry Mash Section, Mr. G. Moran's White Leghorn, laid 280 first-grade eggs.

AVERAGE EGG PRODUCTION

There were 236 fowls in the competition at its commencement, but nine died. The total number of days these latter birds were in the pens was 2,019, which is equal to approximately 6 birds having been there for the full 48 weeks. Therefore, the total number of birds in the competition for the whole period may be regarded as 233, and this is the figure used in working out the averages.

STATEMENT SHOWING THE NUMBER OF EGGS LAID BY THE VARIOUS BREEDS IN THE COMPETITION, AND THE AVERAGE NUMBER OF EGGS LAID PER BIRD.

Breeds.	Number of Birds After Allowing for Deaths.	Eggs Laid.			Average Number of Eggs Laid per Bird.		
		First Grade.	Under-weights.	Total.	First Grade.	Under-weights.	Total.
Light Breeds—Wet Mash—							
White Leghorns	73	15,440	443	15,883	211·5	6·1	217·6
Other Light Breeds—Dry Mash	25	3,820	352	4,172	152·8	14·1	166·9
Light Breeds—Dry Mash—							
White Leghorns	36	7,630	126	7,756	211·9	3·5	215·4
Total Light Breeds—Wet and Dry Mash ..	134	26,890	921	27,811	200·7	6·9	207·5
Heavy Breeds—Wet Mash—							
Australorps	51	10,421	340	10,761	204·3	6·7	211·0
Rhode Island Reds	40	6,421	417	6,838	160·5	10·4	170·9
Other Breeds	8	905	178	1,083	113·1	22·3	135·4
Total Heavy Breeds	99	17,747	935	18,682	179·3	9·4	188·7
Total All Breeds	233	44,637	1,856	46,493	191·6	7·9	199·5

The total number of eggs laid, including those underweight, was 46,493, an average number per bird of 199·5 for 48 weeks.

The prices realized for the eggs averaged a fraction over 2s. 5¾d. per dozen, while the market value of the eggs averaged £2 0s. 3¼d. per bird. The prices received for the eggs, however, are the net prices exclusive of freight and commission charges, &c. It must be remembered, also, that the eggs were laid by pullets in their first period of production under conditions entirely different from those on commercial farms where birds of various ages are kept in large flocks.

Legbar entered by Glenyuille Stud, (Mr. H. D. Stewart), won Class 3 of the competition with a total of 240 first-grade eggs.

FIRST CLASS CERTIFICATES OF MERIT TO OWNERS OF HENS IN CLASSES 1, 2, AND 4 WHICH LAID 240 FIRST-GRADE EGGS, AND IN CLASSES 3 AND 5, WHICH LAID 220 FIRST-GRADE EGGS.

Pen No.	Name and Address.	First Grade Eggs.
	Class 1.—White Leghorns—Wet Mash.	
146	Goddard and Harvey, 356 High-street, Bendigo	293
160	G. R. Lowe, "Blackwood Dell," Lillico, via Warragul	290
139	Bonview Poultry Farm (R. E. Eeles), McIvor-road, Bendigo	274
152	L. J. Jackson, 241 Tooronga-road, Glen Iris, S.E.6	274
154	Sunridge Poultry Farm (D. E. James), Spring Gully-road, Bendigo	272
166	S. G. McPhee, 27 Albert-street Kerang	269
130	H. Baberton 10 Albert-street, Highett	263
140	Bonview Poultry Farm (R. E. Eeles) McIvor-road Bendigo	259
149	T. R. Holdsworth, 202A Windermere-street, Ballarat	258
151	L. J. Jackson, 241 Tooronga-road, Glen Iris, S.E.6	257
200	Marywood Poultry Farm (A. J. Waugh), Helms-road, Kangaroo Flat	257
165	S. G. McPhee, 27 Albert-street, Kerang..	250
196	Kingsley Park Poultry Farm (G. J. Teitz), 21 Kingsley-crescent, Mont Albert, E.10	250
129	H. Baberton, 10 Albert-street, Highett ..	248
157	R. A. Lonie, 1 Chanac-street, East Malvern	245
138	Molson's White Leghorn Stud (G. B. Durkin), 188 Surrey-road, Blackburn	243
164	G. A. McLeod, 4 Bletchley-road, Oakleigh	243
197	L. J. Thornton, c/o North Williamstown P.O.	241
183	G. S. Roberts, 41 McCartin-street, Leongatha	240

Pen No.	Name and Address.	First Grade Eggs.
	Class 2.—White Leghorns—Dry Mash.	
219	A. Johnson, Sunray-avenue, Cheltenham	267
231	Miss A. E. C. Roberts, "Range View," Launching Place	267
232	Miss A. E. C. Roberts, "Range View," Launching Place	263
216	R. E. French, 76 Doncaster-road, Box Hill	261
222	Kostos Bros., cr. Collins and Waverley roads, Oakleigh, S.E.12	259
205	W. H. Clements, 7 Crown-road, Ivanhoe, N.21	256
220	A. Johnson, Sunray-avenue, Cheltenham	242
228	C. C. Mentiplay, Speedwell-street, Somerville	242
	Class 3.—All Light Breeds other than White Leghorns—Wet Mash.	
120	Glenyuille (H. D. Stewart), 34 Soudan-street, Footscray	226
105	J. Doull, 35 Collingwood-road, Newport	220
	Class 4.—Australorps—Wet Mash.	
7	A. and L. Caspar, Box 56, Bacchus Marsh	256
10	F. A. Clark, 39 Jean-street, Cheltenham	256
19	A. E. Head, 38 Serrell-street, East Malvern	256
11	H. D. Cumming, "Jellalabad," Darlington, via Camperdown	254
38	P. Phelan, 11 Traill-street, Northcote ..	253
42	T. P. Sweeney, 61 Rundle-street, Ararat	252
16	E. C. Davis, 91 Flinders-street, Thornbury, N.17	248
43	G. Thomson, "Fortuna," Westall-road, Spring Vale	244
46	D. and J. Tresise, Durham Poultry Farm, Serpentine	242
	Class 5.—Rhode Island Reds—Wet Mash.	
76	D. R. Fraser, Colchester-road, Kilsyth	220

Prize List, Burnley Egg-Laying Competition, 1948-49

SINGLE TEST

Pen No.	Name and Address.	Total Eggs.	Under-weight.	First Grade Eggs.
	Class 1.—White Leghorns—Wet Mash.			
	First Prize—Champion Certificate, also Burnley Champion Sash.			
147	H. E. Hill, 20 Turner-street, North Wonthaggi	308	4	304
	Second Prize—Government Certificate, also Second Prize—Burnley Sash.			
128	L. Abikhair, 41 Wilfred-road, Ivanhoe, N.21	297	1	296
	Third Prize—Government Certificate, also Third Prize—Burnley Sash.			
142	Gibbs' Highway Stud (J. L. Gibbs), Main Eltham-road, Lower Plenty	294	..	294
	Class 2.—White Leghorns—Dry Mash.			
	First Prize—Champion Certificate.			
229	G. Moran, Glenburnie-road, Mitcham	280	..	280
	Second Prize—Government Certificate.			
230	G. Moran, Glenburnie-road, Mitcham	278	1	277
	Third Prize—Government Certificate.			
235	A. A. Skinner, 75 Vincent-street, Sandringham	275	1	274
	Class 3.—All Light Breeds other than White Leghorns—Wet Mash.			
	First Prize—Champion Certificate.			
119	Glenyuille (H. D. Stewart), 34 Soudan-street, Footscray (Legbars)	247	7	240
	Second Prize—Government Certificate.			
104	H. L. Chalmers, 9 Lefevre-street, Spotswood (Legbar)	234	..	234
	Third Prize—Government Certificate.			
102	J. L. Bruce, 12 Cedric-street, Ivanhoe, N.21 (Legbar)	229	..	229
	Class 4.—Australorps—Wet Mash.			
	First Prize—Champion Certificate.			
31	S. H. Hanson, Box 7, Kilmore	269	..	269
	Second Prize—Government Certificate			
4	A. G. Beswick, Penguin, Tasmania	262	..	262
	Third Prize—Government Certificate.			
3	A. G. Beswick, Penguin, Tasmania	258	1	257
	Class 5.—Rhode Island Reds—Wet Mash.			
	First Prize—Champion Certificate.			
89	J. J. Mills, Kelvinside-road, Noble Park	237	..	237
	Second Prize—Government Certificate.			
96	W. M. Wakeham, 20 Frederick-street, Heidelberg	233	2	231
	Third Prize—Government Certificate.			
97	J. Wear, Farm-road, Werribee	226	1	225

Class 5.—All Heavy Breeds other than Australorps and Rhode Island Reds—Wet Mash.

As no birds laid more than 220 first-grade eggs, prizes were not awarded in this Class.

TABLE OF MONTHLY LAYING RETURNS.—1948-49

Month.	Light Breeds.						Heavy Breeds.					
	White Leghorns.			Other Light Breeds.			Australorps.			Other Heavy Breeds.		
	Average No. of Birds.	Total Eggs.	Average.	Average No. of Birds.	Total Eggs.	Average.	Average No. of Birds.	Total Eggs.	Average.	Average No. of Birds.	Total Eggs.	Average.
April	110	1,774	16·1	26	260	10·0	52	1,026	19·7	48	567	11·8
May	110	1,876	17·1	25	238	9·5	52	1,128	21·7	48	675	14·1
June	110	1,668	15·2	25	237	9·5	52	1,063	20·4	48	631	13·1
July	110	1,778	16·2	25	307	12·3	52	1,102	21·2	48	692	14·4
August	110	2,229	20·3	25	402	16·1	52	1,097	21·1	48	775	16·1
September	109	2,551	23·4	25	501	20·0	52	1,130	21·7	48	952	19·8
October	109	2,710	24·9	25	532	21·3	52	1,067	20·5	48	954	19·9
November	108	2,501	23·2	25	483	19·3	52	924	17·8	48	811	16·9
December	108	2,401	22·2	25	447	17·9	51	788	15·5	48	698	14·5
January	108	2,247	20·8	24	416	17·3	51	754	14·8	47	637	13·6
February and March 1st and 2nd ..	107	1,904	17·8	23	349	15·2	50	682	13·6	47	529	11·3

IN THE ORCHARD

By G. W. GAYFORD, B.Agr.Sc.,
Senior Horticultural Instructor

ARE YOUR FRUIT TREES PROFITABLE?

DURING the last few years fruitgrowers, in common with many other producers, have been experiencing seasons which have given them satisfactory financial returns. Growers may possibly contend that the returns received were little enough compensation for the worries and headaches they have suffered in obtaining labour, and in combating pests and diseases.

The fact remains however, that most growers are in a considerably better financial position than in pre-war years.

Heavily laden apple trees in mountainous country near Wandiligong, Vic.

It would be foolish to attempt to forecast what the future holds for fruit growing in so far as overseas markets are concerned, but it seems fairly certain that, with a steadily rising population and greater purchasing power, especially in the larger cities and towns, our future domestic markets will be much better than in pre-war years.

Thoughtful growers with an eye to the future will be giving some consideration to the time when prices may not be as buoyant as at present. In this event, orchards will have to be managed in such a way that every tree will produce some return over and above the amount spent on it each year.

KEEP ACCURATE RECORDS

Most fruitgrowers know how much their orchards produce each year, but few keep detailed records. The idea behind herd testing is extending rapidly among efficient dairymen who value the accurate information provided for each cow of the herd. Poor yielders are not given a place on the farm, and there can be no question that a similar system would be of great value to the fruitgrower. It may not be practicable to keep a record of each tree, as is done on Departmental Research Stations, but a system approximating such record-keeping would certainly be of value in a commercial orchard.

A method in use by one grower of systematic habits could be adopted more extensively. This grower has divided his orchard into a number of blocks and has numbered each row of trees with a painted label. A daily record of the various orchard operations is kept, and the system adopted enables the grower to calculate the amount of time spent on each section and the cost of caring for it. The quantity of fruit harvested is also recorded.

Apart from the value of knowing how much each section of the orchard costs to run, useful information is gained regarding the quantity of spraying chemicals used, and on the weather conditions existing at the time of spraying. This information is valuable later in the season. To quote one

Peach tree affected with the fungus, Polystictus. Such trees should be rooted out and burnt.

example, it is helpful in enabling the efficiency of some of the newer insecticides to be assessed.

The grower has a large quantity of information which he sorts out during slack periods. A record is made of trees which do not yield well or suffer from a pest or disease which is difficult to control by normal orchard spray programmes.

Pear trees on a rootstock which causes stunting, or suffering from black end; apple trees severely cankered from woolly aphis or badly affected with polystictus; peach trees in poorly-drained soil; lemon trees with collar rot—all of these would be located and marked for the axe. The removal and replacement of such useless trees is the most economic method of dealing with them.

"Black Point" on Wheat Grain

Grains in the Victorian wheat sample this year showing black or dark-brown discoloration, particularly on the germ end, are present in greater proportion this season than usual, probably due to the wet conditions prevailing last October, and November.

The usual cause of discoloration is the presence on the grain of moulds or fungi. These may be of little consequence and have no important effect on the grain either for milling purposes or for seed, but, in a number of the samples examined this year, some grains were affected with a disease known as "black point". This infection is caused by a fungus responsible for "foot-rot" in wheat which is a cause of "dead-heads" in the crop.

Naturally, when available, it is preferable to use seed showing no trace of "black point" but if wheat containing grains so affected is used for seed, it is a wise precaution to thoroughly pickle with a suitable organic mercury pickling powder instead of the copper pickling powders commonly used for the prevention of stinking smut or bunt.

Pickling of seed wheat with mercury powders has been shown to prevent infection of the young plants by the "foot-rot" fungus carried on the grain, and to give an effective control of ball smut, but of course it will not prevent infection of the wheat plants by "foot-rot" which may be already established in the soil. Clean, well-worked fallows, adequate manuring and good farming practices generally, assist in reducing the severity of "foot-rot" attacks in the wheat crop.

[Contributed by the Agricultural Division.]

BORON POISONING IN CITRUS

By F. Penman, M.Sc., Deputy Chief Chemist, and D. M. McAlpin, B.Agr.Sc., Horticultural Research Officer

SUMMARY

Boron poisoning symptoms have been identified in citrus in irrigated areas of northern Victoria. Usually only a limited number of trees, mainly on the heavier soils, are affected in any grove. Characteristic symptoms are invariably present if boron content of the dry matter of citrus leaves exceeds 500 p.p.m. Boron native to the soils is considered the chief source of the trouble. Susceptibilities of various types of citrus under Victorian conditions are also described and prospects of control are discussed.

BORON is one of the minor elements, also called trace elements or micro-nutrients, essential in small amounts for the optimum development of plants. A deficiency of this element is known to cause various diseases including "internal cork" of apples, "cracked stem" of celery and "crown rot" of beets. Such diseases have been identified in various parts of Australia, but there is no local record of boron deficiency in citrus. The latter condition has been found in citrus groves of Southern Rhodesia and described by Morris (1938) under the name, "hard fruit".

Citrus leaves showing symptoms of boron poisoning. Left: Tip-burn and slight tip chlorosis. Left centre: Mild chlorotic spotting. Right centre: Severe case of marginal and tip chlorosis, with slight tip-burn. Right: Typical pustule-like elevations on back of leaf.

In using boron compounds, such as borax, as soil dressings to control deficiency diseases, care must be taken not to exceed a certain small application which varies with the particular crop, soil and climate. The reason is that with many crops, boron easily gives symptoms of toxicity. Of all the minor elements, the margin between deficiency and toxicity is probably the narrowest in the case of boron. A good illustration is given by soils of medium texture in the State of Oregon, U.S.A. Jordan and Powers (1946), using beans, found that soils containing less than 0·5 parts per million of available boron were deficient; those with 0·5 to 0·75 gave optimum conditions, while those with more than 0·75 could give toxicity.

No Australian record is known of boron poisoning in plants, other than a few cases due to experimental application of borax. This is rather surprising in view of our large tracts of arid country, such as have been shown by American research workers to have a tendency to accumulate toxic amounts of boron.

The symptoms of boron poisoning in citrus were first recognized in Victoria in 1947. Comparison of the boron contents of affected and healthy orange leaves from the

Light transmitted from the back of the leaf clearly shows the chlorotic spots. The pustules are on the underside of these spots.

Rootstock and Fertilizer Trial conducted by the Department of Agriculture at Irymple in the Mildura district, indicated that an excess of boron was the cause of ill-health of trees in certain parts of the grove. Later this condition was found to be rather widespread in the vicinity of Mildura, and was identified also in the Swan Hill and Rochester districts. Common features are that all these areas are in the north of Victoria, that the citrus is grown under irrigation and that boron injury is manifest in only a limited number of trees in each affected grove, mainly on the heavier soils.

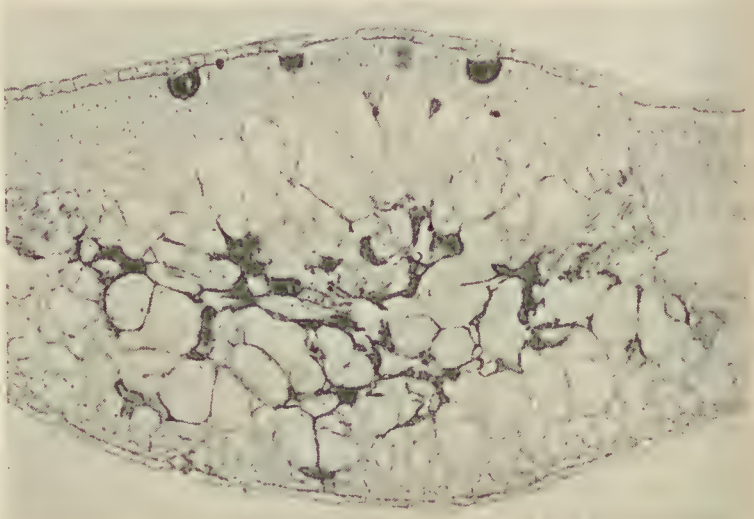
SYMPTOMS OF BORON INJURY

Boron poisoning in citrus trees makes itself evident largely in the form of leaf abnormalities. These include the development of rather irregular areas of yellowish colour between the veins; such areas are usually present along the margins and tips of affected leaves. In general, boron-affected leaves have a green area the shape of an inverted V at the base of the leaf, but such a V is usually broader and less clearly defined than that which is found with magnesium deficiency. A frequent feature is "tip burn" due to death of the leaf apex.

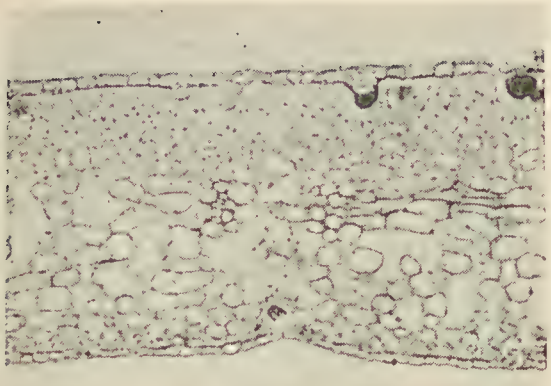
Symptoms of this nature have been ascribed to boron toxicity by Californian workers, who have reproduced the injury by addition of boron compounds to previously healthy trees, both in the field and in sand cultures [Kelley and Brown (1928) and Haas (1929).]

A further characteristic leaf symptom of boron poisoning under Victorian conditions is the presence on the under-side of the leaf of small elevations, pustule-like in appearance. In severely injured leaves, such "pustules" may occur within the yellow or chlorotic areas at the tip and margin. In milder cases they are found on the underside of scattered chlorotic spots, which are most easily discernible when the leaf is held up to the light. At first the pustules are translucent and colourless, but later may become light-brown in colour.

The symptoms of boron poisoning in California are stated by Haas and Thomas (1928) to be similar to sulphate injury, but under our conditions the described symptoms—particularly the pustule, which Camp and



Photomicrograph of transverse section of a pustule in a boron-affected orange leaf. The pustule is due to enlargement of cells in the centre of the leaf—the spongy mesophyll.



Transverse section of a healthy orange leaf. Spongy mesophyll cells are much smaller than those under pustules, and the interspaces much larger.

Fudge (1939) state "is quite typical", have invariably been associated with high boron content of the foliage. Pustules are rare on lemon leaves, but are quite common on boron-affected sweet orange, mandarin, kumquat, grapefruit and sour orange trees.

Structure of Pustules

Histological studies on Victorian specimens of the normal green leaf tissue and the typical chlorotic spots showing pustule, invariably reveal that in the region of the pustules the spongy mesophyll cells are abnormally enlarged. Due to the enlargement of these cells no intercellular spaces are left, in contrast with normal tissue in which such spaces are numerous and large. The walls of many of these enlarged cells show abnormal thickening and evidence of lignification. In advanced stages the enlarged, thick-walled cells collapse, but before doing so, they usually show fewer chloroplasts and bigger nuclei than those found in normal cells. This explains the loss of green colour in the affected area.

The palisade cells directly above the affected spongy mesophyll appear quite normal, and so do the upper and lower epidermal cells.

Defoliation

A heavy leaf fall, particularly during the early spring before the main growth period has commenced, occurs as a result of boron accumulation. Analyses have shown that citrus has a remarkable capacity for accumulating boron in the leaves rather than in the twigs and other woody tissue. For this reason a heavy defoliation assists the tree by discarding an appreciable amount of accumulated boron.

New growth of broader, rounder leaves may cover for a time the bare wood resulting from defoliation, but leaf symptoms usually develop again. Affected trees are characteristically sparse in foliage and scraggy in appearance, often showing twig die-back.

A feature of defoliation due to excess boron is that only the leaf blade falls, leaving the petiole or stalk attached to the tree. The wings of the petiole often show pustules of the kind previously described.

Effect on Cropping

Trees affected by boron poisoning show reduced yields, according to the severity of the symptoms. As injury progresses, the crops borne may become negligible. Very severe injury has resulted in death of trees.

BORON CONTENT OF CITRUS LEAVES

The results of boron analyses of mature citrus leaves from various parts of the State, including some north-eastern and southern localities are given in Table 2.

The petioles are still attached to the twigs of this Sour Orange tree from which all the leaves have fallen. This type of leaf shedding is characteristic of boron injury.

No figures higher than 250 parts of boron per million of dry matter in the leaves have been found by this survey in districts other than those of the north and north-west in which boron toxicity symptoms have been identified. Within these latter districts, figures range up to 2,460 p.p.m. in an exceptional case, but commonly up to 1,200 p.p.m. Figures of this order are similar to those found by Kelley and Brown (1928), Scofield and Wilcox (1931) and Eaton (1935) for citrus leaves in California subject to boron injury.

The Victorian figures together with those available from investigations overseas indicate that boron contents up to about 100 p.p.m. may be taken as normal. Between 100 p.p.m. and 300 p.p.m., citrus is usually able to tolerate the boron without showing toxicity symptoms. The range from 300 p.p.m. to 500 p.p.m. is one in which signs of injury may or may not be detectable (compare Eaton, 1935), but above 500 p.p.m. poisoning symptoms are prevalent to varying degree.

The Department of Agriculture Rootstock Trial at Irymple has provided an excellent opportunity for relating tree health and yield with boron accumulation. The main facts are set out in Table 1.

TABLE 1.—SHOWING RELATION BETWEEN HEALTH OF WASHINGTON NAVEL ORANGE TREES ON SOUR ORANGE STOCK AT IRYMPLE AND BORON ACCUMULATION IN LEAVES.

Extent of Boron Poisoning.	Boron Content of Leaves. (Parts per Million in Dry Matter.)
Very severely affected	2,460
Severely affected	890
Slightly affected	530
Healthy	102

The badly affected trees have been in an unthrifty condition for some years, with symptoms now recognized as those of boron toxicity, whereas the slightly affected trees had been assessed as healthy until 1947.

TABLE 2.—BORON CONTENTS OF VICTORIAN CITRUS LEAVES.

(Parts per million of the dry matter.)

Type of Citrus.	Locality.	Boron Content. In Presence of Characteristic Symptoms of Boron Poisoning.	Boron Content. In Absence of Characteristic Symptoms of Boron Poisoning.
Washington Navel Orange	Mildura ..	1,120	..
	Merbein ..	590	200
	Irymple ..	530, 530, 560, 660, 720, 890, 1,080, 1,340, 2,460	88, 116, 116
	Red Cliffs	378, 394	..
	Bamawm	880, 880, 1,140	250
Valencia Late Orange	Merbein ..	820, 1,150 1,700	..
	Irymple ..	430, 525, 560, 620, 1,030	118, 120, 285
	Red Cliffs	..	120
	Long Lake	..	331
	Tresco ..	..	131
Lemon ..	Merbein ..	650, 855	..
	Red Cliffs	680	332
	Boundary Bend	..	65, 83, 101, 122
	Nyah ..	800	435
	Bamawm	835	94, 112
	Ky Valley	..	250
	Cobram ..	..	18, 27, 30, 48, 50, 69 75, 100, 146
	Yarrawonga	..	130
	Wangaratta	..	75, 80
	Grovedale	..	125, 135
	Templestowe	..	55
Citronelle (rough lemon)	Red Cliffs	760, 950	..
Grapefruit	Red Cliffs	..	260, 315
Mandarin	Red Cliffs	..	150, 170, 185
Tahiti Lime	Gunbower	..	50, 72

The important point brought out by Tables 1 and 2 is that variations in boron content of the leaves are related in a consistent way with variations in the incidence of a certain set of symptoms. This has a vital significance in the decision that such symptoms are in fact due to boron poisoning.

Further consideration of Table 2 is warranted from the aspect of possible indications of boron deficiency in any of the districts surveyed. The lowest boron contents of citrus foliage are in samples from the Cobram and Yarrawonga districts, the least being 18 p.p.m. The only known standard for comparison is provided by the work of Morris in Rhodesia. This worker found that deficiency symptoms were associated with boron content of citrus leaves below 13 p.p.m. The Victorian analyses so far are all above this level. It is of interest that Piper (1936), in a survey covering 48 samples of South Australian apples, found no boron contents below 12 p.p.m. of the dry matter and most above 20 p.p.m. Askew (1935) found in New Zealand apples that internal cork symptoms were associated with boron contents up to 8 p.p.m.

BORON CONTENTS OF TWIGS AND PETIOLES

An example of concentration of boron in the leaves of citrus rather than in woody tissue was found in a Washington Navel orange tree at Merbein. This was badly affected by boron injury of the kind associated with a leaf boron content of 1,000 p.p.m. Defoliated twigs from the tree contained only 150 p.p.m. of boron.

On a different property at Merbein, where boron content of affected foliage ranged from 650 to 850 p.p.m., the petioles remaining on a heavily defoliated sour orange tree contained 465 p.p.m. of boron while immature leaves from the same tree contained 115 p.p.m. This is in accordance with the ability of citrus trees affected by boron injury to make apparently normal growth for a time following the shedding of high-boron leaves, until the new foliage itself accumulates a toxic concentration of boron.

Sour Orange tree showing defoliation due to boron poisoning. In the upper left-hand portion of the tree, the older leaves have been shed from the twigs which still retain the younger foliage at their extremities.

SUSCEPTIBLE STOCKS AND VARIETIES

It is obvious from inspection of affected groves that there is a big variation in susceptibility to boron poisoning of citrus trees according to the rootstock and scion varieties used.

Rootstocks

As an example, at the Irymple Rootstock Trial, which includes the two scion varieties Washington Navel and Late Valencia oranges, trees of either variety on citronelle stock are more affected by boron than those on sour orange, while those on sweet orange stock are only slightly affected.

It is not considered that this position of sweet orange is due entirely to its known shallow root habit, since there is evidence that this stock takes up less boron than citronelle under similar conditions and seems better able to tolerate considerable accumulations of boron in the leaf tissue.

Leaves deficient in magnesium have a clearly defined green inverted "V" at the base of the leaf.

TABLE 3.—AVERAGE YIELDS OF 14-YEAR-OLD WASHINGTON NAVEL ORANGE TREES IN CITRUS ROOTSTOCK TRIAL, IRYMPLE 1948 (LB. PER TREE).

Plots.	Rootstock.*	
	Sweet Orange.	Citronelle.
Boron-affected Plots ..	463	256
Healthy Plots	544	504

* Yields of trees on sour orange stock are not included owing to the high incidence of the virus disease "bud-union decline".

Trees on grapefruit stock in Victoria have been observed to be very susceptible to boron poisoning. Our present experience is that trifoliata stock is little if any more susceptible to boron poisoning than sweet orange.

This would appear to be at variance with the findings of Haas (1945) in California that trees on trifoliata stock accumulate most boron, followed by sweet orange, grapefruit and lastly sour orange.

Scion Varieties

In a number of groves there is evidence that lemons are more susceptible to boron than other citrus scion varieties. The indications so far are that after lemons, the following commercial types are decreasingly susceptible to boron poisoning—sour orange, mandarins, kumquat, grapefruit, and sweet orange. The greater susceptibility of lemon scion than that of sweet orange has been observed in California—Chapman and Kelley (1943).

As mentioned previously, lemon leaves do not commonly show the typical pustule-like elevation on the under-side of the leaf when they are poisoned with boron, but they do exhibit a severe chlorosis and tip burn.

POSSIBLE SOURCES OF THE BORON CAUSING INJURY

In 1928 Kelley and Brown attributed certain toxicities found in citrus under field conditions in California to boron accumulation and found that irrigation water, usually from bores, was the chief source. In a few cases, boron native to the soil was responsible and in other cases accidental contamination of irrigation water had occurred, due to effluents containing boron from citrus packing sheds. A further source of boron in U.S.A. was from fertilizers, especially impure potassium fertilizers.

Irrigation Waters

Examination of Victorian irrigation waters, especially from the vicinity of Mildura, has so far not shown any high results for boron. The highest figure obtained is 0·4 p.p.m. of boron, but the range 0·03 to 0·10 p.p.m. is more representative. Scofield and Wilcox (1931) suggest that the critical boron concentration in irrigation waters for lemons lies somewhere between 0·5 and 1·0 p.p.m. On this basis, irrigation waters are not likely to be the main cause of the injury observed in Victoria; this is confirmed by the manner in which affected groves are distributed.

Fertilizers and Soil Amendments

Chemical analyses of a potassium fertilizer used on the Rootstock Trial at Irymple showed that it contained 37 p.p.m. of total boron, practically all of which was

water-soluble. Gypsum samples so far analysed here range from 6 to 15 p.p.m. of total boron and from 0·5 to 8 p.p.m. of water-soluble boron.

Spectrographic examination of a representative range of Victorian fertilizers and soil amendments, carried out by courtesy of Defence Research Laboratories, Maribyrnong, has revealed no more than traces of boron in any of the materials. Superphosphates, sulphate of ammonia, potassium fertilizers, blood and bone and ground limestones were included in this survey.

It is therefore unlikely that applications made to the soil in the form of fertilizer or soil amendment are factors of importance here. Gaddum and Rogers (1936) found boron contents up to 0·5 per cent. in a range of fertilizers in Florida.

Soils

The proportion of boron in water-soluble form in soil is the most significant, from the aspects of both toxicity and deficiency. In a survey of American soils, Whetstone *et al* (1942) found that surface soils of humid areas ranged from 0·6 to 2·5 p.p.m. in content of water-soluble boron, while desert soils contained up to 127 p.p.m. in this form. There was a tendency for boron in the surface soils to exceed that in the subsoils, except in irrigated soils with clay horizons in the subsoil, when boron tended to concentrate in the clay layers.

Kelley and Brown (1928) found that the water-soluble boron in soils carrying healthy citrus and walnut varied from a trace to 0·3 p.p.m., while soils where such crops were injured showed contents of 2·3 to 21 p.p.m. of boron in this form.

Whetstone *et al.* (1942) cite three cases of boron injury to lemons in California, due to irrigation water, in which the upper 30 inches of soil had contents of water-soluble boron of 1·3, 1·5 and 1·8 p.p.m. Haas (1944) mentions troubles in Californian citrus soils with water-soluble boron ranging from 2·5 to 10.7 p.p.m.

Water-soluble boron in soils of the Victorian areas where boron injury has been identified varies up to 16 or more p.p.m. The indications are that in many of our northern soils there is sufficient native boron to give injurious effects on sensitive crops under certain conditions.

Citrus tree affected with boron poisoning. Note chlorotic margins and tips of leaves. The green inverted "V" at the base of the leaf is not clearly defined.

In virgin Mallee soils it has been found that water-soluble boron content can rise quite sharply from moderate figures, less than 1 p.p.m., in the surface soils to more than 10 p.p.m. in the subsoils at about two feet deep, coincident with the advent of heavier horizons and lime. This gives a new emphasis to the existing preference for deep sandy soils, with a minimum of lime, for citrus under irrigation. Even on such ideal soils some boron injury may develop—a striking case is the finding of boron injury, associated with a leaf boron content of 950 p.p.m., in two-year-old citronelle seedlings established at Red Cliffs on Murray Sand. This area had been cleared two years previously from virgin cover and these seedlings had received no fertilizer and had been spray irrigated. The surface soil here contained 1·8 p.p.m. of water-soluble boron.

The fact that boron may increase with depth in our soils also underlines the necessity for full precautions against the building up of the water-table under irrigation and for close attention to drainage and the maintenance of rapid water percolation in citrus soils.

An example of re-distribution of chloride, and probably also of boron, was investigated in the Rochester district in a grove where high water-tables had developed under irrigation. The bores mentioned in Table 4 were only a few chains apart in an area where boron toxicity symptoms in citrus were prevalent. The figures show that concentration of chloride in particular spots in a property and at more or less defined levels in the soil may be accompanied by concentration of water-soluble boron.

TABLE 4.—SHOWING DISTRIBUTION OF CHLORIDE AND WATER-SOLUBLE BORON IN ROCHESTER CITRUS SOIL SUBJECT TO HIGH WATER-TABLE.

(Boron as p.p.m., chloride as sodium chloride parts per 100,000.)

Depth.	Bore 1.		Bore 2.	
	Boron.	Chloride.	Boron.	Chloride.
0″— 6″ ..	0·7	11	0·7	20
6″—12″ ..	0·7	39	1·1	20
12″—24″ ..	15·5	143	1·7	42
48″—60″ ..	15·2	79	5·5	14

The finding of notable proportions of boron in soils of northern Victoria is not surprising in view of the fact that sea-water contains an appreciable proportion of this element and the cyclic salt theory attributes salt accumulation in these areas mostly to marine salt carried by wind and rain (Prescott 1944).

As a result of study over many years, much is known of the behaviour of chloride in Australian soils. It is now clear that various aspects of the boron situation in our soils merit attention.

RELATIONS BETWEEN BORON INJURY AND INJURY DUE TO CHLORIDE AND SULPHATE

Many investigations of the health of citrus trees in Australian irrigation areas have shown a relation between accumulation of chloride in the soil and unthriftiness, defoliation and even death of the trees, associated with high chloride content in the leaves—see for example Penman and Provan (1935). Nevertheless, in a considerable number of instances of citrus injury where field observations have suggested salt as the likely cause, laboratory examination by the Department revealed that the chloride concentration in the affected leaves was below toxic proportion. It now seems probable that at least some such cases were due to boron poisoning, especially in its less severe forms when some of the characteristic symptoms may be suppressed.

Although the soil examinations indicate that boron might run parallel with chloride in causing injury to citrus, determinations for both boron and chloride in the leaves for more than 40 samples show that this is not so. Actually the indications are that high boron in the leaf is associated with moderate to low salt contents, also that high salt content is associated with moderate boron content.

Further reference is desirable here to the possible confusion between boron injury and sulphate injury in citrus. It is considered that recognition of the complete set of symptoms, including the characteristic "pustule" and the method of abscission of mature leaves, taken together with the relations between tree health and boron accumulation in the foliage, are sufficient to establish boron as the cause of injury in the Victorian areas concerned. An example of the opposite finding has been recorded in California where Foote and McElhiney (1937) investigated a spotting of citrus foliage which they attributed to sulphate, since boron in the leaves varied over a comparatively narrow range and did not exceed 320 p.p.m., while sulphate variations appeared to parallel the variations in tree health.

PROSPECTS OF CONTROL

Restriction of citrus planting to deep permeable sands such as Murray Sand, Berri Sand and the deeper variants of Barmera Sand would appear to be the

prime control measure. Where citrus groves run from these types of soil to heavier soil types such as Barmera Sandy Loam, boron poisoning symptoms may be more prevalent on the heavier land.

Whatever soil type is concerned, the closest attention should be given to ensuring that water penetration is not impeded; this often results from building up a high water-table, or from compaction of the surface soil. In this connexion, interesting field observations are that boron poisoning as found in one grove localized in the vicinity of a blocked drain, and that similar symptoms are prevalent on other properties near old tracks and dwellings. Once boron accumulation has occurred, it may be difficult to remove by leaching, which is probably the best method of control.

There are also possibilities of control by adjustment of the proportions of other plant nutrients including nitrogen, potassium, phosphorus, calcium and iron. The antagonism between calcium, for example, and boron in plant nutrition is well known. Soil reaction and organic matter are likely to be important factors.

As regards stocks, sour orange is excluded from consideration because of its liability to "bud-union decline" except when lemon is the scion. However, lemon scions are not recommended in localities subject to boron accumulation. On the evidence presented in this account it is suggested that careful consideration should be given before using citronelle as a stock in localities where boron trouble may be anticipated. Of the remaining stocks, namely, sweet orange and trifoliata, the latter is recommended, only for Valencia orange and mandarin varieties.

The practice of "skeleton pruning", which has proved effective for temporary relief in cases of manganese toxicity in citrus in Victoria, might logically be applied to trees poisoned by boron. This practice, which removes all but the main framework of the tree, is best carried out in the early spring.

Investigations along the above lines will be continued, together with further observations of the incidence of boron poisoning on plants other than citrus.

METHODS OF CHEMICAL ANALYSIS

In the earlier chemical work here, a titrimetric determination of boron, using mannitol, was applied in the manner outlined by Dodd (1929), after preliminary treatment of soils, leaves and other materials along the lines described by Berger and Truog (1939). Most of the work however has been done with the quinalizarin colorimetric procedure, essentially as described by the last-named authors, incorporating the use of a tintometer, as suggested by Maunsell (1940).

Acknowledgments

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THE VEGETABLE GARDEN

By GEORGE HYAM, Horticultural Supervisor

DESIGNING THE VEGETABLE GARDEN

As there is little planting to be done over the next eight weeks or so, now is a good time to improve the garden layout for better results and easier working. Long beds running north and south, about 4 or 5 feet wide, and divided by a narrow walk, are the easiest to work, and this aspect gives the crops the maximum amount of sunshine which all vegetables need. With narrow beds undue trampling of the soil is avoided, as they can be worked from either side. If the beds are banked up a little, this will give an extra depth of top soil, provide surface drainage and make any hand operations easier.

On farm gardens, consideration might be given as to the location of the home vegetable plot. It sometimes happens that a better and more easily worked area can be found away from the immediate neighbourhood of the homestead. Nearness to a good water supply is an advantage, such as a dam or creek.

The State Rivers and Water Supply Commission in its bulletin "Farm Water Supplies" estimates that during dry weather the average farm gardens need 500 gallons of water daily for each ¼ acre of garden. On the farm, the vegetable plot is best laid out in a narrow rectangle so that horse cultivation can be used.

On gardens of half an acre and upwards, the cost of one of the small garden tractors which will perform all cultural operations, including dusting or spraying, would soon be saved by the elimination of most of the hand labour. Wherever such plots are located, adequate shelter from wind and full protection from rabbits are essential. As a temporary protection from wind until a permanent wind break has grown, strips of rye corn or, in summer, maize or artichokes planted in strips, will give adequate protection. For full protection against the prevailing winds space the rye strips about 33 ft. apart and the maize or artichokes, 66 ft. apart.

Suppression of weeds is essential in the vegetable garden whether done by manpower or implements.

HARVESTING AND STORING CUCURBITS

During the month of April, most pumpkins, marrows, and squashes will be sufficiently mature for storage.

Different varieties of pumpkins have a varied storage life. Turk's cap and butter pumpkins can be stored for some weeks, but should be used before Triamble or Queensland Blue varieties, which are the best keepers grown here.

The life of any variety in storage is regulated by two main factors—picking at the right stage and proper storage conditions. No immature cucurbits will keep for long. They should be fully matured on the vines if it is intended to store them for any length of time. Individual fruits mature at different times, but they are ready to harvest for storage when stems on the fruits become withered.

For storage, pumpkins and squash should be cut off with about 2 to 3 inches of stem adhering. If the stems are pulled off, rots will quickly develop at the stem scar. Pumpkins and squash should not be stored directly upon the ground or on earth floors. They are best kept under cover and where there is plenty of ventilation.

The Triamble pumpkin is an excellent keeping variety. Portion of the stem should be left on for storage.

If any quantity is to be stored and especially in the open, the fruits should be stacked on their sides. A heavy frost can damage stored pumpkins, and if kept until spring, the hot midday sun of the northern areas may cause deterioration. Large stocks should be looked over and any fruits showing signs of decay promptly removed.

Mice and rats should be guarded against. Small household quantities are best stored under an airy verandah, or in a well-ventilated shed, in single layers with a small space between each fruit.

Most squash will keep well under these conditions. Even cucumbers will keep for a few weeks, but these should be picked slightly before maturity, also with a small piece of stem attached, and stored in a cool dark place where the air can circulate around them. Water and pie melons will store fairly well under similar conditions for four or five weeks. However, for melons and cucumbers, careful handling is necessary as the least bruise will start decay and they will deteriorate at temperatures under 40 degrees. Oversized cucurbits generally have a shorter storage life than the normal-sized fruits.

OTHER APRIL WORK

The main plantings in April are the seedlings of leeks which should be planted in well-manured soil. Plant in dibber holes just deep enough to leave 2 or 3 inches of foliage above ground. Drop the seedlings in the holes but do not fill them with soil after planting. Apply some water and this will cover the roots with sufficient soil.

Deep planting ensures a good length of white stem when the leek matures. This vegetable grows its foliage pointing outwards from two sides and these should thus be facing up and down the row to facilitate cultivation as the plants mature.

Leeks are an easy vegetable to grow and can be harvested over a long period throughout the winter and spring. They are quite usable long before full maturity. In the home garden, the usual spacing for leeks is about 8 or 9 inches in the row and 18 inches between rows.

Other April plantings of seedlings are early onions (Flat White or Early Queen) Eastham or Savoy cabbage and Late Metropole cauliflower.

Lettuce will transplant readily now the weather is cooler, the best varieties for present planting being Imperial D or Webb's Wonderful. These are better planted on a slight ridge if the soil is heavy to provide surface drainage in wet weather. In the high cool districts hearting lettuce seldom reach maturity during the winter months without being attacked by mildew. However, the non-hearting endive (or curly lettuce) and Cos lettuce are rarely subject to this trouble and will provide green salad for winter use in such areas.

Turnips, carrots, parsnips, and beetroot can be sown in the northern irrigation areas. The autumn sowing of broad beans should be completed early in the month, after which later sowings are best planted in late July–August, except in the north of the State where they can still be planted in May, June, and July. Any beds not required for present planting should be dug over as soon as the summer crops are taken off, limed at the rate of about ¼ lb. to the square yard, and then left with the surface of the soil in the rough until required for winter or spring planting.

THE FLOWER GARDEN

WINTER AND SPRING FLOWERING ANNUALS

THE planting of early spring flowering annuals may be continued during early April, and seedlings of Iceland poppy, calendula, nemesia, viola, pansy, cineraria and primula can be planted in well-prepared soil.

It is an advantage at this time of year to plant all these seedlings in raised beds, so that surface drainage will enable the first 6 inches of the soil to remain warmer and drier than it would be if the beds were flat.

CINERARIAS

The seedlings of cinerarias should be planted under shelter, either along walls or under shrubs and trees. These seedlings require plenty of light, but also protection from frost. In dry positions be sure that they do not suffer from lack of water; sometimes when these seedlings are planted at the foot of walls they receive little rain and must be watered by hand.

The most popular cinerarias at present are the Grandiflora strain. These grow to a height of about 1½ feet and produce large, well-formed flowers with a good range of colours. It is possible to obtain this Grandiflora strain in mixed as well as in separate colours. The separate colours include heavenly blue, blue with a white centre, crimson, dark scarlet and brilliant scarlet.

Another form of this plant is the Stellata or Star-shaped strain, which grows to about the same height, but the flowers are not so compact.

THE VIRGINIA STOCK

The fragrant Virginia stock, while still a member of the same large family as the ordinary, large-flowered stock, is not in the same genus. Its botanical name is *Malcolmia maritima*, and it is sometimes called the French Forget-me-not. It can be used for edgings, long borders and for window boxes.

The seed should be sown from now until the spring, and usually, where it is to remain. Thin out the plants to about 6 inches apart. The colours are mixed, white, yellow, crimson, carmine, &c. It grows to a height from about 6 inches to 1 foot.

NEMOPHILA

Nemophila is a hardy, blue-flowered annual which carries its white-centred flowers on stems about 1 foot tall. Sow the seed now in a cool and partially shaded place. It is advisable not to transplant. A rich light soil suits it best.

PRIMULA

The primula is a perennial but in our gardens it is usually treated as an annual. It makes an excellent subject for window boxes and for winter and spring borders in the garden.

It grows to a height of 12 to 18 inches, and is also a good subject for pot plants and can be brought indoors when it commences to flower and will continue flowering for a long period if placed in a sunny position. It may be used also for massed bedding effects out-of-doors. It is a plant which does fairly well in a semi-shaded position and flowers from twelve to fourteen weeks.

Various colours are available and include lilac, white, rose pink and crimson.

Seedlings may be transplanted now, or seed may be sown for transplanting later to provide blooms in late spring. At this time of year, self-sown seedlings will often be found in undisturbed soil where primulas were growing last year. Space the plants 6 to 8 inches apart, and an application of 6 oz. to the square yard of lime will be found beneficial.

Suitable varieties are *Brilliancy*, which is a dark purplish red, *Princess Mary*, a rose lilac, *True Rose*, a rose shade and *Dawkin's Pink*, a good deep pink.

THE GRAPE INDUSTRY IN CALIFORNIA

Observations made by Frank M. Read, M.Agr.Sc., Chief Inspector of Horticulture, during a visit last year to the United States of America.

The first portion of this paper, in which Mr. Read recorded his observations on the dried grape industry in California appeared, in our April issue.

TABLE GRAPE PRODUCTION

TABLE grapes for local consumption, their trans-shipment to eastern United States and export are a major industry in California, and the level of efficiency is very high. Grapes are available from June to the following April out of store. The main variety is Emperor, a red grape, high yielding and a good transport and storage grape. It ripens about ten days earlier than Ohanez and a little later than Purple Cornichon with which it compares more than favorably.

United States Department of Agriculture Horticultural Research Station, Fresno. Mr. Elmer Snyder (left), in charge of grape production investigations, and Mr. Wilbur T. Pentzer, who directs handling and storage research.

It is surprising to learn that, although Emperor was introduced in 1865, it has not since been found in any of the countries from which the introduced grapes were obtained. It is a strong growing vine, grown on a 5 ft. trellis, surmounted by a sloping T piece with two wires. A main wire about 3 ft. 6 in. from ground level carries on either side of the trunk an arm 2 ft. 6 in. to 3 ft. long with four to five spurs on each arm, each spur being cut to three buds.

Other varieties of commercial significance are Thompson Seedless for the early market, Flame Tokay, Muscat of Alexandria, Malaga, Red Malaga, Ribier, and Almeria (Ohanez).

My attention was specially directed to new varieties including the following :—

Cardinal

Cardinal is a very early, large red grape named in 1946 and now grown to the extent of 2,500 acres for fresh fruit, ripening in late June or early July, i.e., its time from blossoming to maturity is only about two-thirds of the time taken by Thompson Seedless or the Australian sultana.

Monukka, a late red seedless raisin or table grape of high quality and good yield.

Perlette and Delight

Perlette and Delight are two new white grapes rather like Thompson Seedless but earlier in season.

Calmeria

Calmeria is a new seedling Ohanez with perfect blossoms and appears to be a regular bearer. It is not inferior to Ohanez in flavour, size or bearing and has a more golden green colour. It should become an important grape and would be of interest in this country.

H-5-35

H-5-35 is a new hybrid with Red Malaga (Maraville) in its parentage (Maraville x Ah Sarbi) x Tafafihi Ahmer. It is rather like Red Malaga, large berry, rather tough skin and late. It would be a good carrier.

H-5-50

H-5-50 (Ribier x Karro Belle) has a very compact bunch of large black uniform berries and is a good late bearer. It has a better flavour than Ribier.

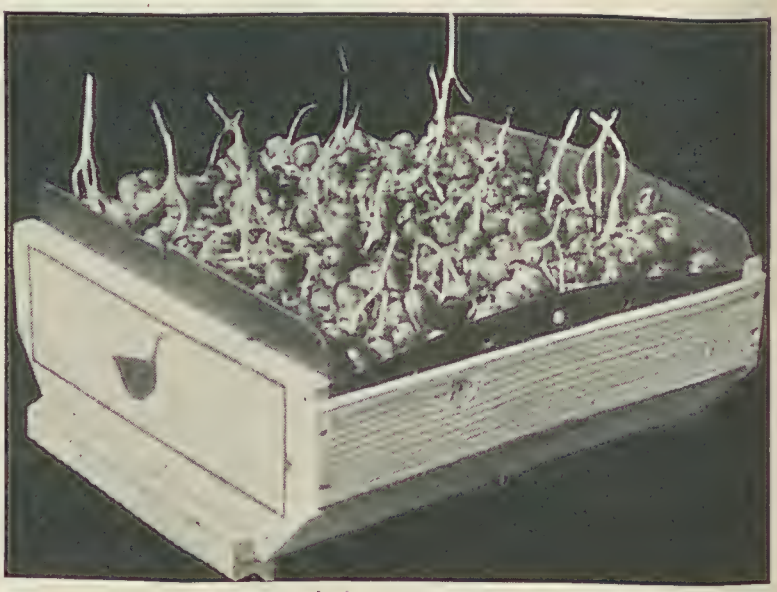
Black Monukka

Black Monukka is a strong growing vine with high yield and, when girdled, gives good bunches of large dark red seedless grapes of attractive eating quality. This grape was first introduced as a raisin grape, and even to-day growers are paid £3 a ton more for Monukka than Thompson. However, although everyone to whom I spoke liked the Monukka, it has not yet made much headway.

PACKING AND HANDLING OF TABLE GRAPES

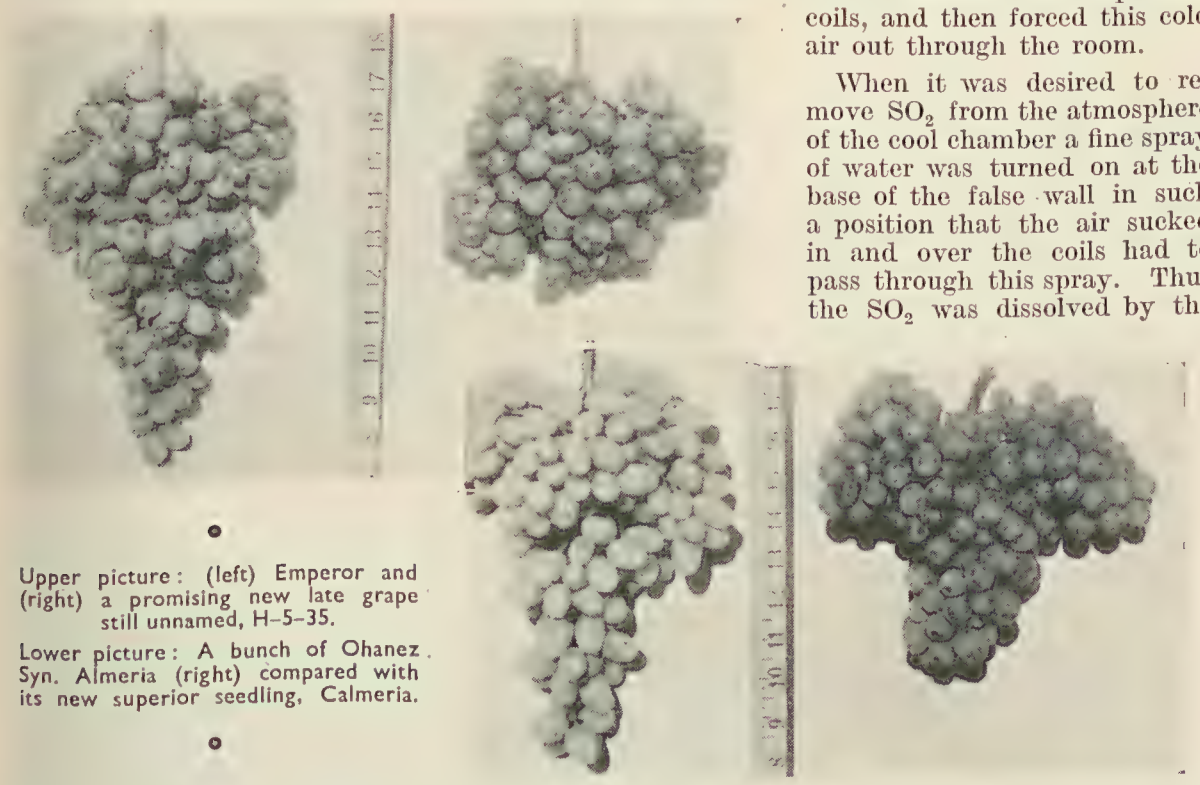
The method of packing in California is different from that adopted in Victoria. The case is placed on the flat and the bunches are placed vertically in the box, not horizontally as in this State. First and second-grade fruit is distinguished by having the stems up in the first-grade fruit, and down in the second-grade.

The Prentis lug packing box illustrated is popular in California for grapes. The bevelled bottom permits better ventilation in storage room or in rail car transit. Cardboard inserts to protect the fruit at the junction of lid and case are perforated to assist ventilation as much as possible.



Emperor grapes, top quality, packed for New York market in the "Prentice Lug" box. Note bevelled bottom for better ventilation and perforated cardboard inserts. The base is slightly extended, also to aid ventilation in the stack.

At the Senger Fruitgrowers' Association Packing House, which I was told was fairly typical of good practice in California, fruit for transport to Eastern U.S.A. or abroad is loosely placed in the export cases and cooled for twenty-four hours, usually at 32° F. If sawdust filling is to be used, a half-inch of it is placed on the bottom of the case. The sawdust used for packing is also stored in the cool room. Before taking the case out of the cool room to be lidded, it is filled with cold sawdust which insulates it and prevents sweating when removed. The sawdust is said to be treated to remove taste. The cool room in which fruit is stored is treated with sulphur dioxide before the fruit is removed for final packing and 5 grms. of powdered sodium bisulphite are added to the top of the sawdust before lidding.



Upper picture: (left) Emperor and (right) a promising new late grape still unnamed, H–5–35.

Lower picture: A bunch of Ohanez Syn. Almeria (right) compared with its new superior seedling, Calmeria.

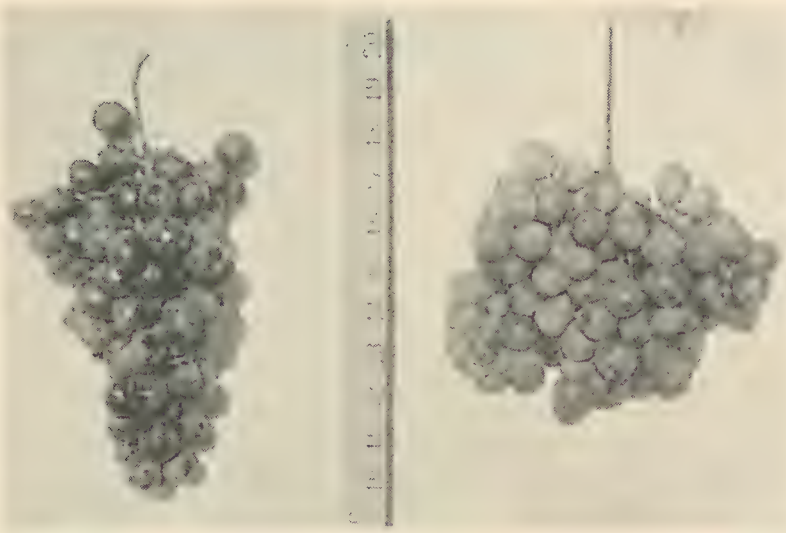
The packed box contains 34 lb. of fruit and 10 lb. of sawdust which, together with 6 lb. the weight of the box, gives a total weight of 50 lb.

I visited also the packing house of Setrakians and Co., Fresno, where grapes were being packed for the New York market. No sawdust was used for this trade. The fruit, after packing, was gassed with sulphur dioxide (1 per cent. by volume) in a special room with a ceiling fan which introduced and distributed the SO_2 and later was reversed to function as an exhaust fan. If such fruit is held in cool store at 32° F. it is treated with SO_2 sufficient to provide $\frac{1}{4}$ per cent. in the atmosphere every ten days, the appropriate quantity of SO_2 being liberated into the room through special pipes from a cylinder of SO_2 outside. This cylinder is heated in water so that the hot SO_2 gas diffuses more readily.

The cool storage room was heavily piped with direct expansion coils on the wall. Over the coils a false wall was placed which, however, did not extend quite to the floor or the ceiling. At ceiling level fans drew up the air from the bottom opening of the false wall over the expansion coils, and then forced this cold air out through the room.

When it was desired to remove SO_2 from the atmosphere of the cool chamber a fine spray of water was turned on at the base of the false wall in such a position that the air sucked in and over the coils had to pass through this spray. Thus the SO_2 was dissolved by the water which ran out of the chamber by means of a gutter.

I was told by officers of the United States Department of Agriculture that 10,000 cubic feet per minute per 34,000 lb. of fruit is the air flow necessary for pre-cooling in a refrigerated room or rail car. This should bring a properly stacked load of fruit at



Two promising late grapes, H–5–50 (left), black, and H–5–35, red.

90° F. down to 38°—35° F. in eighteen hours using air no lower than 29°—30° F. for pre-cooling.

This packing house and cool store was operating on a completely palletized system, the fork load tractor being electrically worked on 42-volt accumulators recharged every eight to ten hours. Packing benches and conveyors supplied by Food Machinery Corporation were very modern. Automatic conveyors fed boxes of fruit to the packers and another conveyor removed the empty boxes. All packers packed on to a scale so that the quantity of fruit placed in the box could be read directly during packing.

REFRIGERATED RAIL TRANSPORT

All perishable products, such as fruit, seem to move exclusively in refrigerated cars in the United States. These usually have an end bunker for ice and a fan, driven off the ground wheels of the car when in motion, to circulate cold air from the ice bunker throughout the loaded car.

In many centres a mobile track-side pre-cooling plant was available to cool fruit placed in the truck before the departure of the train, and in all centres icing facilities were available. In the larger places, special overhead equipment was provided at the railway yard for icing the cars; but in smaller places a local contractor would bring the ice from his ice works in the town and raise it to the bunker openings at the top of the rail car by means of an elevator mounted on a special truck. The contractor's job, for which he was paid £3 per car load, plus £2 per ton of ice used and a small charge, in the case of grapes, for sulphur dioxide, was roughly as follows :—

When the fruit is loaded and the car is made ready for transit by the packer, the icing contractor immediately fills the bunkers with ice and operates the air distributing fan in the bunkers by means of a small motor which he attaches to the fan's driving shaft. Thus, cooling of the fruit goes on until the consignment leaves the railway yard. If its stay is prolonged in the yards he will keep the bunkers full of ice and will always give a last minute loading so that they are full when they leave. The contractor, when dealing with grapes, also charges the rail car with sulphur dioxide from a portable

Mobile elevator re-icing a refrigerated rail car near Fresno, California.

outfit consisting of a cylinder which is warmed by the side of the line in a water bath heated by a Primus stove. This heated bath, as in the case of the cool store, ensures rapid diffusion of the warmed sulphur dioxide. Facilities exist along the route for periodical icing and sulphuring wherever necessary.

"Arbor" or overhead trellis for Ohanez grapes, Exeter, California.

It will be seen, therefore, that in the handling of perishable products, the Americans spare no effort to control temperature and to protect grapes continuously with sulphur dioxide. Since a large part of California's grape crop has to travel 3,000 miles across the Continent, often under trying climatic conditions, such precautions are, of course, necessary. In Australia, it is inevitable that similar methods of transporting perishable products will have to be adopted more widely to improve the outturn and the sales of our fruit and vegetables. In view of the losses which we have had recently in the export of fresh grapes from Victoria, there is a valuable lesson to be learned from the use of sulphur dioxide and continuous control of temperature.

WINE INDUSTRY

Unfortunately, I was not able to make any systematic observations on wine production in California, owing to lack of time, and the following brief remarks are based, therefore, only on casual observations. The practice of naming wines after the grape variety from which they are made seems to be the basis of California's nomenclature, and people are becoming familiar with the wines. It seemed to me an effective and pleasing practice.

The two new wine grape varieties raised by the University of California Agricultural Experiment Station—Ruby Cabernet and Emerald Riesling—continue to increase in popularity. Ruby Cabernet, a hybrid of Carignane x Cabernet Sauvignon, aims to combine high yield with high quality for red wine production. This grape has already demonstrated that it will produce 4 to 5 tons per acre under conditions where Cabernet Sauvignon, its pollen parent of outstanding quality, produces only 2 to 2½ tons. Further, it produces a red, dry wine of high quality. The other new grape, Emerald Riesling, is a high yielding white grape of good quality. A description of these varieties is contained in the California Agricultural Experiment Station Bulletin No. 704, May, 1948.

Automatic temperature control is being strongly recommended in California for improved wine making. In California it is of major importance for the production of sound wines, even where full attention is given to the use of sulphur dioxide and pure yeast, as a control measure in fermentation.

An article on this subject by Professor G. L. Marsh appeared in *California Agriculture*, April, 1948, and would be of interest to wine-makers who are not familiar with such recent wine-making developments in California.

Infectious Eye Disease in Cattle and Sheep

By G. NICOL, B.V.Sc., Veterinary Officer.

AN infectious disease of the eye commonly known as "pinkeye", occurs in cattle and sheep at certain times of the year in most parts of Australia.

The disease in cattle is due to a different infection to that in sheep, but in each species the symptoms are essentially similar, and the term infectious ophthalmia can be applied in both cases. This can often be a most distressing type of infection, and in advanced cases or in cases which have not been treated, it can cause permanent blindness and severe damage to the eye structures.

In early cases, before major damage has occurred, there is often an excess of secretion which may run down the side of the face, while the lining membrane of the eye cavity may be inflamed.

SYMPTOMS

The first sign of this early conjunctivitis is a slight engorgement of the eye capillaries which become red and swollen. There is a greater outpouring than normal of tear fluid, but otherwise the condition does not appear to be very severe. At this stage treatment is essential in preventing development into a secondary stage in which the eye discharge thickens, and becomes contaminated by bacteria, causing gumming of the eyelids. The discharge scalds the skin of the face, mats the hair together and makes a generally uninviting appearance. When the gummed-up lids are forcibly separated, the membranes surrounding the eye are seen to be greatly swollen and inflamed with a deep red appearance typical of an acute inflammatory process. There may be some degree of pus, while the third eyelid may protrude prominently and even project over the eyeball. Later, the eye presents an opaque appearance.

Many sheep and cattle show raised pinkish-white elevations which may become perforated, causing ulcer formation and often permanent loss of sight. Even when these ulcers heal, there is often a big change in the normal eye shape due to contraction of the scar tissue formed in healing. This also causes interference with normal sight. In many cases there is fever, with loss of appetite and a consequent falling away in condition.

The disease is infectious. The infection can be transmitted by secretions carried from one animal to another. Flies act as carriers of the infection.

TREATMENT

Early treatment is important. It is useless to wait until there has been perforation of the eyeball and then expect any eye ointment or eye wash to clear up the condition. Opacity of the cornea does not always mean that the case will not recover, but prolonged treatment is necessary to effect a cure in these long-standing cases.

In early cases there are numerous eye lotions suitable for treating the condition. The material used should be mildly antiseptic and non-irritant. In this class some such eye irrigant as boric acid can be used in a 4 per cent. solution or combined with 2 per cent. zinc sulphate. Organic preparations of silver such as argyrol are useful and easily administered.

Where the trouble appears, it is best to treat all cattle in a herd or all sheep in a flock, as many animals which are apparently free from infection at the onset of the disease may later develop symptoms. Such mass treatment will limit the percentage of infection on a particular property. Treatment should be carried out daily for several days. With valuable stock additional precautions may be taken, such as protection of the animal's eyes from dust and the sun's rays and twice-a-day treatment with an eye lotion.

Irrigated Pastures in Victoria

By A. MORGAN, B.Agr.Sc., Senior Irrigation Officer.

Part I. of this series appeared in our March issue.

SEASONAL DISTRIBUTION OF PRODUCTION

For an analysis of seasonal distribution of yield of clippings from a rye grass-cocksfoot-white clover pasture, and an evaluation of the effects of variation in manurial and irrigation treatment, the most convenient method is graphical.

The relevant graphs, showing the production rate of the pasture in pounds of dry matter per day, are reproduced on pages 200 and 202.

They are taken from pages 194 and 195, *Journal of Agriculture*, Victoria, April, 1932 (Bartels, Beruldsen, and Morgan).

Grading irrigation land with a buck-board.

An alternative method found very useful was to determine by analysis of variance the error of yield of each plot cut, and to designate statistically significant differences as + or −, while those not statistically significant were classed as P and N (positive or negative).

A further table, to show the results of this examination, is unavoidable. In its simplest form, it records the number of +, −, P, or N differences for the total cuts for each treatment.

Summarizing, the experiment showed that—

(*a*) Phosphatic manures showed the greatest all-the-year-round efficiency (i.e., 22 significant increases) in raising the production rate, the relative efficiency of the fertilizer being governed by its readily available P2 O5 content.

(*b*) Superphosphate was relatively most efficient during those periods when growth on unmanured pasture was handicapped by adverse conditions of dryness in summer or low temperatures in winter.

(*c*) Nitrogenous and other manures stimulated growth for a short period only (e.g., two to four significant increases out of a total of 22 cuts).

VARIATION IN YIELD OF DRY MATTER AT EACH CUT 1929–30 AND 1930–31.

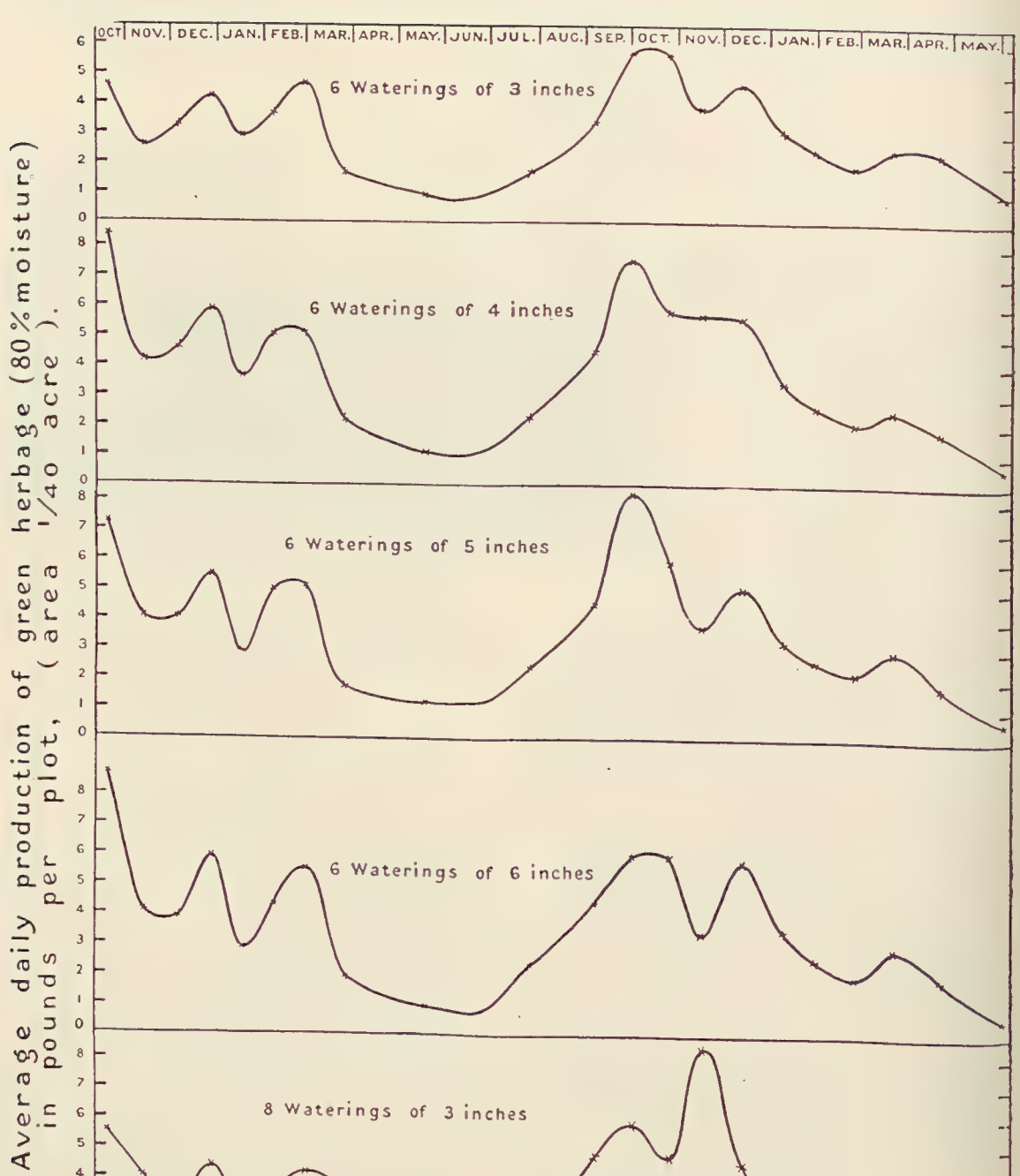
State Research Farm, Werribee, Field 2 S.W.

Plot Comparison Made.	Analysis of Differences for the Two Seasons.				
	+	P.	N.	−	Total Cuts.
With "No Manure"—					
Plot receiving superphosphate only	22	..	..	..	22
Basic slag, 2 cwt.	22	..	..	..	22
Rock phosphate, 2 cwt. ..	17	5	..	..	22
Nitrate soda, 1 cwt.	2	13	7	..	22
Ammonium sulphate, 1 cwt. ..	3	6	12	..	22
Potassium sulphate, 1 cwt. ..	2	7	13	..	22
With "Superphosphate 2 cwt."—					
Superphosphate 2 cwt., plus nitrate soda 1 cwt.	4	..	4	14	22
Superphosphate 2 cwt., plus ammonium sulphate 1 cwt. ..	4	..	1	17	22
Superphosphate 2 cwt., plus potassium sulphate, plus ammonium sulphate	2	..	2	18	22
Superphosphate 2 cwt., plus potassium sulphate	2	..	4	16	22
Superphosphate 2 cwt., plus lime	4	3	3	12	22
Superphosphate 2 cwt., plus gypsum	3	3	4	13	22

\+ Significant increase. − Significant decrease.
P. Increase (not significant). N. Decrease (not significant).

As with most field trials, the results outlined might be considered to be limited in their application for the following reasons, amongst others :—

(*a*) The experiment was limited to one type of irrigation treatment (water as required).


Average daily production of green herbage (80% moisture) in pounds per plot, (area 1/40 acre).
OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY. JUN. JUL. AUG. SEP. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY.
6 Waterings of 3 inches
6 Waterings of 4 inches
6 Waterings of 5 inches
6 Waterings of 6 inches
8 Waterings of 3 inches
DATE OF CUT NOV 2, 24. DEC 19. JAN 6, 28. FEB 17. MAR 10. APR 11. JUN 23. AUG 28. SEP 16. OCT 17. NOV 5, 29. DEC 29. JAN 2. FEB 13. MAR 11. APR 4. MAY 12. JUN 27

The graphs show average daily production of green herbage.

(*b*) The manures were applied at a time arbitrarily fixed (autumn).

(*c*) The experiment was confined to a particular soil type.

(*d*) The experiment was confined to a particular climate.

(*e*) The lawn-mower technique might not give results comparable to grazing.

In regard to *a* and *b*, it can be pointed out that those methods are the ones most commonly used on irrigation farms.

In regard to *c* and *d*, plots established at Swan Hill, Tongala, Stanhope, Cohuna, &c., gave similar results.

In regard to *e*, the experiments were repeated in part under a "grazing and yield sampling" technique and gave comparable results. However, before passing on to this phase of research, it will be convenient to examine the results of tests connected with *a*, *b*, and *c*, i.e., variation in irrigation treatment, variation in time of application of fertilisers, and tests in the northern irrigation districts on other soil types.

A near view of a highly-productive pasture of paspalum and white clover on the property of Messrs. Nancarrow Bros., Wandella.

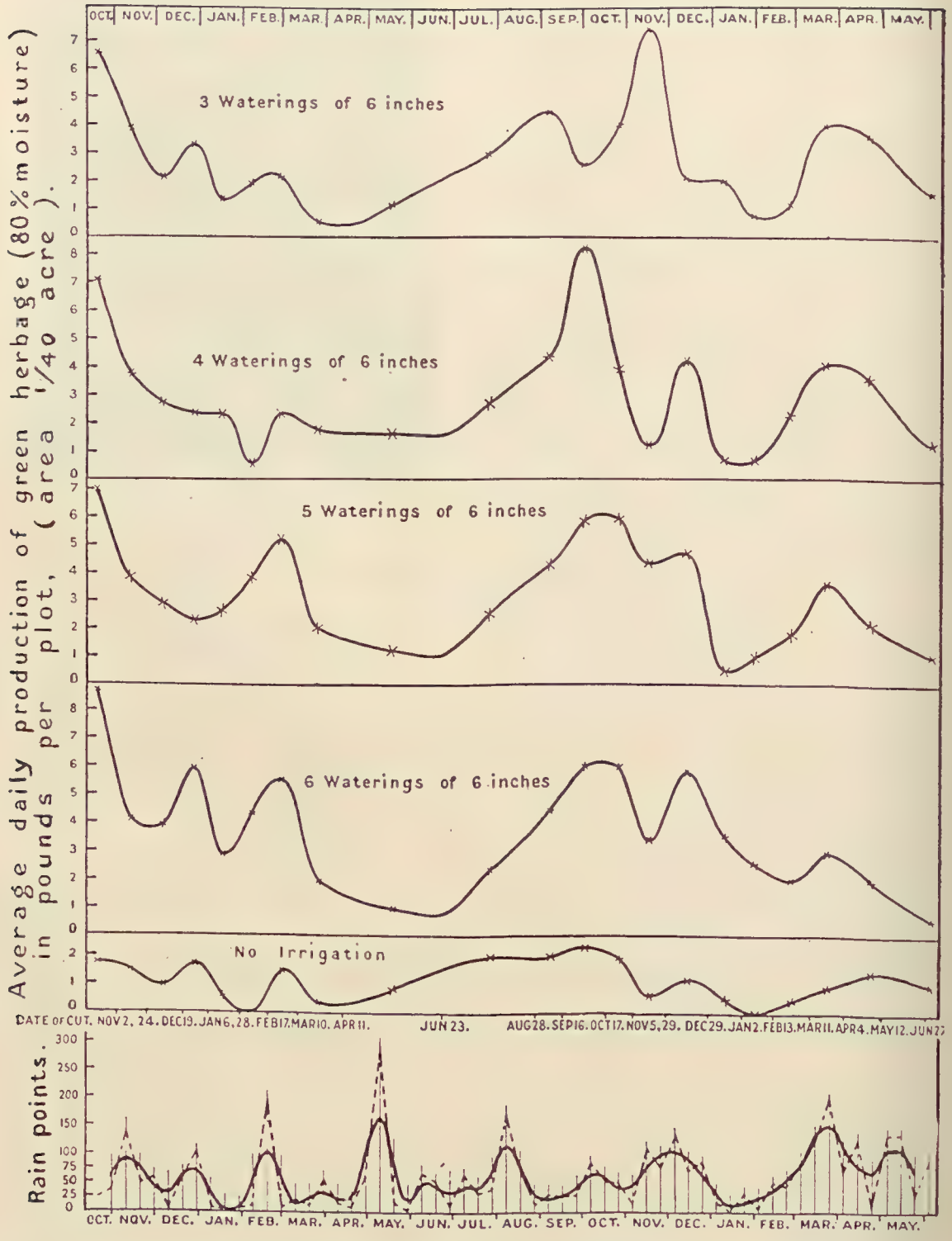
AVERAGE YIELD FOR SEASONS 1934–35, 1936–37, 1938–39.

(Field 2 S.W.)

Manurial Treatment per Acre.	Yield of Dry Matter per 1/66th Acre.		
	Watered Fortnightly.	Watered Three-weekly.	Watered Monthly.
No manure	66·7	61·1	54·9
Superphosphate, 1 cwt.	106·7	112·4	98·6
Superphosphate, 2 cwt.	118·2	112·0	94·3
Superphosphate, 3 cwt.	134·4	117·5	88·6
Superphosphate, 4 cwt.	137·5	113·0	93·6
Basic slag, 2 cwt.	100·2	89·0	78·1
Rock phosphate, 2 cwt.	98·2	74·7	64·5
Nitrate soda, 1 cwt.	74·4	69·1	58·0
Ammonium sulphate, 1 cwt.	74·1	66·1	52·1
Superphosphate, 2 cwt., plus nitrate soda, 1 cwt.	106·5	90·0	74·8
Superphosphate, 2 cwt., plus ammonium sulphate, 1 cwt.	111·0	97·2	75·7
Potassium sulphate, 1 cwt.	69·0	60·6	52·4
Superphosphate, 2 cwt., plus potassium sulphate, 1 cwt.	101·8	91·5	75·1
Superphosphate, 2 cwt., plus potassium sulphate, 1 cwt., plus ammonium sulphate, 1 cwt.	107·0	96·9	75·2
Superphosphate, 2 cwt., plus lime, 30 cwt.	104·4	97·3	82·9
Superphosphate, 2 cwt., plus gypsum, 30 cwt.	99·5	100·8	82·7

NOTE.—Average three seasons :—

	Inches.
Watered fortnightly	
Total water applied	23·05
Average watering	1·61
Watered three-weekly—	
Total water applied	16·32
Average watering	1·69
Watered monthly—	
Total water applied	13·20
Average watering	1·72
Total rainfall for test period	21·74


OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY. JUN. JUL. AUG. SEP. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY.
3 Waterings of 6 inches
4 Waterings of 6 inches
5 Waterings of 6 inches
6 Waterings of 6 inches
No Irrigation
Average daily production of green herbage (80% moisture) in pounds per plot, (area 1/40 acre).
DATE OF CUT. NOV 2, 24. DEC 19. JAN 6, 28. FEB 17. MAR 10. APR 11. JUN 23. AUG 28. SEP 16. OCT 17. NOV 5, 29. DEC 29. JAN 2. FEB 13. MAR 11. APR 4. MAY 12. JUN 27
Rain points.
OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY. JUN. JUL. AUG. SEP. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY.

Graphs showing average daily production of green herbage and rainfall distribution.

FURTHER EXPERIMENTS IN IRRIGATION PROCEDURE

Certain results obtained with manurial trials were stated to be subject to possible criticism on the score of irrigation method employed, which was "irrigation as required".

This aspect was investigated during 1933–1939, when a field with the sixteen manurial treatments, which have been quoted, was re-arranged to test the following irrigation treatments (on a Latin square arrangement):—

(1) Watered fortnightly.
(2) Watered three-weekly.
(3) Watered monthly.
(4) Watered autumn and spring.
(5) Watered as required.
(6) Watered three-weekly, with supplementary waterings.

Full details of the trial are set out in the State Research Farm, Werribee, Guide Book, 1939 (pp. 32–35), from which the foregoing table was taken.

Analysis of the above test elicited information to the effect that:—

(*a*) Fortnightly watering gave the highest and best sustained production.

(*b*) With an average absorption of 1·61 inches per watering, the total water applied each year approximated 2 acre feet in the case of the "watered fortnightly" treatment, and this amount of water per acre per annum proved to be the best in the previous "Rate and Frequency of Watering" test.

(*c*) Despite the much longer intervals between watering in the case of the other two treatments, the amount of water absorbed with each application was very little more than the amount absorbed on the plots "watered fortnightly".

(*d*) Under each watering treatment, superphosphate alone was the most efficient manurial treatment.

(*e*) Combinations of other manures with superphosphate depressed production.

(*f*) When about 2 acre feet of water per annum is applied supplemental to an annual rainfall of 20 inches, there is good response from heavy applications of superphosphate, the 4-cwt. superphosphate per acre plots in the "watered fortnightly" bays giving the highest yields.

(*g*) When total water (rainfall plus irrigation) falls considerably below 44 inches per annum, as it does in the case of the plot watered every three or four weeks, the pasture does not take advantage of the heavier applications of superphosphate.

(*h*) A consideration of the results for each season has shown that high rainfall greatly increases the efficiency of the heavier applications of manure in the less-frequently watered plots.

The alterations to botanical composition which resulted from the changes in irrigation treatment were as marked as in previous experiments, and were, of course, responsible for the altered yields.

Irrigation white clover thrives on self-mulching soils. This pasture was grown by Messrs. T. Bott and Sons, Dingwall.

BOTANICAL COMPOSITION CHANGES INDUCED BY ALTERATIONS IN IRRIGATION TREATMENT

It seems opportune at this stage to discuss the methods by which botanical composition of a pasture is measured. Much thought and ingenuity have been devoted to this problem. Essentially, the problem is to secure a reasonable accuracy without overloading the job with masses of observations which subsequently require a great deal of arithmetical work and analysis.

For exact work, of course, harvesting and separating by hand into separate species or groups of species, and weighing same, is the best method. But this method requires a great deal of time and a large staff. Mostly, therefore, investigators have relied on quicker methods which, though subject to sampling errors, are sufficiently accurate, and are repeated so many times that the results obtained are quite acceptable.

The merits and demerits of these methods have been fully discussed by Dr. William Davies in an illustrated report. One interesting method evolved in New Zealand was to use a frame holding ten long pins and to determine the number of times a particular species was hit by the points of the pins in a given number (say, ten) of trials.

The result of such a test might be, for example, rye grass, 20 hits; cocksfoot, 40 hits; white clover, 35 hits; weeds, 5 hits.

If the grass and clover was short and not vigorous, and the weeds were vigorous and bulky, the above figures would not convey a true picture of the botanical composition of the pasture. At the State Research Farm, therefore, an "estimation of weight" method, employing a 4-square link quadrat, was adopted, and, as the same two operators were doing the work continuously, the results were very satisfactory, and were employed in analysis of the yields of dry matter obtained from each treatment.

Each pasture plot of approximately 300 square feet area (this plot size having been tested and found satisfactory, five replicates were employed) was sampled in ten places just before each cut.

The weight of each species on the particular quadrat area was estimated, with a total value of ten. A typical estimation would be rye grass, $1\frac{1}{2}$; cocksfoot, $3\frac{1}{4}$; miscellaneous grasses, $\frac{3}{4}$; white clover, $3\frac{1}{2}$; strawberry clover, trace; subterranean clover, $\frac{1}{2}$; weeds, $\frac{3}{4}$.

A separate estimation of "bare space", maximum ten points, was made in each case to evaluate the efficiency of the pasture in regard to ground cover (i.e., the denseness of the sward).

In the following table, the average botanical composition, 1934–35 and 1936–37, of the superphosphated plots is shown under the fortnightly, three-weekly, and monthly watering systems.

Reference to the following table supplies interesting information in regard to the influence of watering methods and the inter-action of water and manure. The more important practical advantages accruing from frequent watering and heavy manuring with superphosphate are:—

(1) Good grass-clover balance.

(2) Good development of perennial clovers (white clover and strawberry clover) to the exclusion of the annual clovers (viz., subterranean clover). The best comparison in this case is between the "watered fortnightly, superphosphate 4-cwt." plot, where the "total clover 51·6 per cent." consists entirely of white and strawberry, and the

Saffron thistles are often prominent in the first season of lucerne or pasture. Good management promotes vigorous growth which soon eliminates weeds.

MANURIAL TESTS, WITH SUPERIMPOSED WATERINGS.

(Field 2 S.W.)

Plot Treatment.	Total Grasses.	Total Clovers.	Bare Space.
	%	%	%
Watered fortnightly—			
No manure	66·4	29·3	15·5
Superphosphate, 1 cwt./ac.	53·1	46·0	6·6
Superphosphate, 2 cwt./ac.	49·9	49·3	5·0
Superphosphate, 3 cwt./ac.	49·4	50·4	3·0
Superphosphate, 4 cwt./ac.	48·2	51·6	1·9
No manure	62·1	36·4	13·8
Watered three-weekly—			
No manure	66·6	27·9	20·2
Superphosphate, 1 cwt./ac.	51·9	47·4	9·3
Superphosphate, 2 cwt./ac.	48·5	51·1	6·2
Superphosphate, 3 cwt./ac.	51·4	48·1	5·4
Superphosphate, 4 cwt./ac.	51·3	48·5	4·6
No manure	62·9	35·6	16·6
Watered monthly—			
No manure	64·4	29·7	23·7
Superphosphate, 1 cwt./ac.	51·2	47·3*	15·1
Superphosphate, 2 cwt./ac.	59·2	39·3	11·4
Superphosphate, 3 cwt./ac.	60·4	38·5	13·2
Superphosphate, 4 cwt./ac.	53·6	45·3	10·5
No manure	68·6	29·0†	22·0

* Drought resistant strawberry clover mainly. †Mainly subterranean clover.

"watered monthly, superphosphate 2 cwt." in which the "total clover 47·3 per cent." consists of 22·1 per cent. of subterranean clover and 25·2 per cent. of perennial clovers.

(3) Best conditions for development of perennial rye grass. Thus, approximately 10 per cent. of rye grass was maintained on the 4-cwt. superphosphate plots under the different watering treatments as compared with only 5 per cent. on the unmanured areas.

(4) Suppression of weeds. The weed figures are not given in detail here, but, briefly, the weed content was reduced, by manuring, from around 5 per cent. to ½ per cent.

(5) Density of the sward. This is apparent from the "bare space" (ground cover) figures, which show very consistent reduction as irrigation frequency and manurial rates are increased.

All these avantages will be lost, however, if grazing management is not of a reasonable standard.

To complete the picture, we should look at this same matter of botanical composition

Super. and seed mixed for sowing on experimental plots.

and yield under the other three watering systems employed in the experiment, viz., watered "autumn and spring", watered "three-weekly with supplementary waterings", and watered "as required".

Coincidental with the yield fluctuations tabulated above, the botanical composition and density of the sward were improved to the greatest extent on those plots where the frequency of irrigation was such as to approximate most closely to continuous optimum moisture relationships.

Pasture treated with 2-cwt. super. per acre. Note growth of clovers.

Bare space, for instance, even on the unmanured plots, was reduced to 23 per cent. on the "watered as required" area; with an annual top-dressing of 4 cwt. of superphosphate per acre, it was reduced to 3½ per cent.; subterranean clover and weeds were reduced to 0·4 per cent. on the latter plots.

The main conclusions reached as the result of this section of the experiment were :—

(*a*) Infrequently watered pasture does not take fullest advantage of the heavier dressings of superphosphate.

(*b*) The "watered as required" system of irrigation is the most efficient particularly when the pasture is topdressed with superphosphate at the rate of two bags per acre per annum or more.

(*c*) If, for any reason, it is impossible to irrigate at short intervals, the provision of heavier irrigations at longer intervals by a system of supplementary watering will compensate to a marked degree. In this matter, however, soil type becomes an important factor, particularly in those areas where a permeable soil is associated with a high "salt" content of the deeper horizons of that soil. This most important aspect will be discussed in detail later. Further, some soils are impermeable and no advantage is secured by supplementary watering.

(*d*) The persistence of good strains of perennial species, in spite of the withholding of water in the summer months

MANURIAL PLOTS WITH SUPERIMPOSED WATERING TREATMENTS, 1935–36 AND 1937–38.

Yields of Dry Matter (lb. per $\frac{1}{66}$ acre). Average of two seasons.

Manurial Treatment per Acre.	Watered Spring and Autumn.	Watered Three-weekly with Supplementaries.	Watered as Required.
No manure	51·8	60·3	63·1
Superphosphate, 2 cwt.	100·2	122·8	129·5
Superphosphate, 4 cwt.	104·0	137·0	153·0

NOTE.—Average two seasons—

	Inches.
Watered spring and autumn—	
Total water applied	14·67
Average watering	1·83
Watered as required—	
Total water applied	24·70
Average watering	1·45
Watered three-weekly with supplementaries—	
Total watered applied	23·23
Average watering	2·44
Total rainfall for test period	18·00

from the "watered autumn and spring" sections, was shown throughout the trials and demonstrated even more forcibly during the 1938–39 season. This does NOT imply that a negligent watering treatment will result in the establishment of a good pasture; it means that a good pasture, thoroughly established by good irrigation treatment, can "survive" when water supplies fail and can be rapidly rehabilitated when the supply returns to normal.

Pasture treated with 2-cwt. super and nitrogenous fertilizer. Note growth of grasses due to the use of nitrogenous manure.

TIME OF APPLICATION OF SUPERPHOSPHATE.

Many irrigation farmers are convinced that the time of application of superphosphate to permanent perennial pasture exercises a strong influence on the production of the pasture.

This view has not been supported by the results of experimental work, using the motor-mower technique. The following table shows the results obtained in three seasons at the State Research Farm.

As the highest production was obtained from the plots receiving Super. 4 cwt./ac. in one application, there appears to be no advantage in splitting the annual dressing. On the other hand, if financial considerations force the irrigator to split the annual dressing, he may be assured that no appreciable loss in production occurs provided the total annual dressing is maintained at 4 cwt./ac. or more.

TIME OF APPLICATION OF SUPERPHOSPHATE TEST.
FIELD 2 S.W., S.E. SECTION, STATE RESEARCH FARM, WERRIBEE.

Treatment.	Production in Pounds of Dry Matter, Total of 5 Plots.			
	1933–34.	1935–36.	1937–38.	Total.
4 cwt./ac. Super. applied in April	238·6	240·1	209·6	688·3
4 cwt./ac. Super. applied as 2 cwt./ac. in April, 2 cwt./ac. in October	235·4	240·5	208·2	684·1
4 cwt./ac. Super. applied as 1 cwt./ac. April, 1 cwt./ac. July, 1 cwt./ac. October, 1 cwt./ac. January	229·6	237·0	196·4	663·0
4 cwt./ac. Super. applied as 2 cwt./ac. April, 1 cwt./ac. July, 1 cwt./ac. October	230·5	239·6	194·0	664·1

A third instalment of this article will appear in a subsequent issue of the *Journal*.

Contagious Pleuro-Pneumonia of Cattle

By B. C. HAGELTHORN, B.V.Sc., Veterinary Officer.

CONTAGIOUS pleuro-pneumonia of cattle—more commonly known to cattlemen as "pleuro"—is a highly contagious pneumonia generally accompanied by inflammation of the pleura. The pleura is a transparent paper-thin tissue of cells lining the lungs and the chest wall.

This disease was introduced into Australia in the middle of the nineteenth century and has since proved a scourge to the cattle industry. It spread to all the States of the Commonwealth except Tasmania which is free from the disease. Rigorous action by the Victorian Government has eradicated the disease from this State, but sporadic outbreaks occur from time to time due to introduction of cattle from other States.

In the shaded area "A", pleuro-pneumonia is commonly present; in area "B" the disease occurs at intervals. The crosses mark the location of outbreaks in 1946/47.

A policy of slaughter of all in-contact cattle will eradicate the disease from a country and this procedure was adopted by England which is now free of " pleuro ". The economic loss involved in such a scheme is great, and control by such a method is impracticable in Australia at the present time. In this country the disease is firmly established in northern and north-western Queensland, in the northern part of Northern Territory, and the north-eastern portion of Western Australia.

The difficulty of controlling this disease in the large cattle runs of the northern States can be imagined where fences are scarce and cattle are mustered generally only once a year. However, it is imperative that this should eventually be overcome as, due to the highly contagious nature of the disease, havoc would be wrought amongst the highly susceptible cattle in the southern States should uncontrolled outbreaks occur. As it is the sporadic outbreaks which take place in this State cost the farming community and the Government many thousands of pounds.

CAUSE AND INFECTIVITY

The disease is caused by a small micro-organism known as *Borrelomyces peripneumoniae* and is transferred from animal to

animal by droplet infection. This means that the organism is contained in small particles of moisture breathed out by cattle. To contract the disease, therefore, there must be direct contact with an infected animal.

A popular misconception relating to the spread of this disease is that paddocks and yards which have contained infected animals become contaminated and a source of danger to other cattle. The fact is that once infected animals have vacated a paddock or yard, there is no danger of infection to other cattle which might use them, even immediately afterwards.

The period taken for an animal to contract the disease after direct contact with an affected animal varies from two to fourteen weeks. The majority of cases usually occur between five to eight weeks after contact.

Occasionally an animal will recover from the disease often after having shown no outward signs, the pneumonic area becoming sealed off from the rest of the lung by the formation of a fibrous capsule which encloses the affected portion. Such an animal then becomes a "carrier" of the disease but, while in that state, is not infective to other animals.

The "carrier" animal constitutes the biggest obstacle in the successful control of this disease and is generally the cause of an outbreak of "pleuro" in this State. The usual sequence of events in such an outbreak is that cattle from the northern States containing a number of carriers are sold as stores in Victoria, if they have not already been purchased privately. Sometimes, possibly due to the long trek, drought, or other cause, an encapsuled area in the lungs of a carrier will "break down", the condition spreading through the substance of the lungs and becoming infective to other cattle. This causes an outbreak, which if unchecked, would cause appalling losses in a very short space of time.

SYMPTOMS

Symptoms, which are typical of a condition of pneumonia and pleurisy, are high temperature, lack of appetite, thirst, extreme pain, and difficulty in breathing.

Usually the first sign of the trouble among cattle is an animal standing on its own in the shade. On closer examination a typically affected animal will show an increased rate of breathing, and a discharge of clear mucus from the nostrils. The head will be lowered and extended, the back slightly arched, and elbows wide apart. Because of the pain suffered affected animals rarely lie down, unless in advanced stages of the disease when they become very weak.

If an animal with the disease is driven at the run for some distance the respiratory symptoms become more marked, breathing becomes rapid and often distressed and the majority of cattle will give a soft cough which conveys the impression that the exertion is causing pain to the animal. After a run, affected cattle become excitable, especially station cattle, and show a tendency to charge human beings, particularly anyone on foot.

Their temperature is very high, often reaching 107 deg. F. (normal 101 deg. F.). A raised temperature is one of the first symptoms, but in practice this can be discovered only in dairy cattle.

In the acute stage, the disease progresses rapidly, animals quickly lose condition, become lethargic and finally go down on the ground, where respiration is very laboured and accompanied by grunts, death ensuing in several hours. In odd cases a dropsical swelling occurs on the brisket.

Not all infected cattle show typical symptoms, however, and it is often impossible to detect such animals from their appearance. Detection of these and the "carrier" animal depends on a blood test.

POST-MORTEM EXAMINATION.

In this disease the lungs are the organs which show the characteristic changes. On making an opening into the thorax, the most striking feature is the presence of a clear, straw-coloured fluid around the lungs. This varies from several ounces to more than a gallon and is the so-called "virus". In early acute cases it is wholly fluid, but later coagulates, forming a gelatinous yellow crust on the pleura or lining on the lungs. This "virus" or pleuritic exudate is present in the great majority of cases but not all.

One or both lungs may be affected, the condition involving all or portion of a lung. The affected lung is larger than normal and instead of being soft to the feel is of the consistency of liver.

The lung is divided into lobules approximately one-half inch in diameter by partitions which, in the normal case, are not readily

noticeable. In the diseased lung, however, the partitions are greatly enlarged making the lobules very obvious. A further striking feature is that these lobules, instead of being pink, are of various colours such as red, purple, brown, and sometimes yellowish-green. The partitions between the lobules also contain "virus" which exudes when the affected lung is cut, the whole cut surface having a marbled appearance.

Adhesions of lungs to chest wall are often encountered and these are a sequel to pleurisy.

DIAGNOSIS

Contagious pleuro-pneumonia is diagnosed as follows :—

(*a*) Inspection in the field. Affected animals showing symptoms are picked out by symptoms as described.

(*b*) Post-mortem examination.

(*c*) Collection of blood samples from suspected cattle.

The serum or clear portion which separates after the blood coagulates, is subjected to the Complement Fixation Test at a laboratory.

The collection of blood samples from all in-contact cattle is necessary to determine the carriers and those cattle which do not show visible symptoms.

CONTROL

There is no treatment for this disease. Some years ago contagious pleuro-pneumonia was eradicated from Victoria and since then only sporadic outbreaks have occurred. As the economic loss from this disease is great, no effort is spared by the Department in stamping out such outbreaks.

The method of control used is as follows :—

1. Tracing and quarantine of all infected and in-contact animals and quarantine of roads where necessary.

2. Immediate slaughter of all visibly affected animals in the field.

3. Collection of blood samples from all suspected and in-contact animals where disease is active and slaughter of all positive reactors at abattoirs. Collection of blood samples is repeated from cattle on properties where active cases or positive reactors have been discovered. These are taken not less than three months after date of first collection.

4. Vaccination of all animals from which blood samples are taken. This is a preventive measure only and will not cure the disease. Cattle sometimes die up to fourteen weeks after vaccination. These are generally cattle vaccinated during the incubation period in which the vaccination has little effect.

All vaccinations for this disease are carried out by officers of the Department of Agriculture.

Owing to the long incubation period and the "carrier" animal, "pleuro" is exceptionally difficult to control. It is probably the worst contagious disease affecting cattle in Australia.

It is a notifiable disease under the Stock Diseases Act and compensation is paid on all animals slaughtered provided they have been in Victoria for three months or more. Any person suspecting this disease in his cattle should immediately report the matter to the local Stock Inspector or Veterinary Officer.

BOOK REVIEW

Technique of Breeding for Drought Resistance in Crops by T. Ashton, Technical Communication No. 14, Commonwealth Bureau of Plant Breeding and Genetics, Cambridge, 1948, pp. 34. Obtainable from C.A.B. Liaison Officer, 314 Albert-street, East Melbourne, C.2. Price 3s. 2d.

The important published information relating to the problems of breeding for drought resistance in the principal farm crops, is reviewed. Much of the account is devoted to wheat. Maize, sweet corn, barley, rice, and millet are only briefly covered. The important fact is brought out that, although water is one of the most important factors limiting the growth of crops, little specific breeding for drought resistance has been done. There is a bibliography of 124 references.

SEED POTATO CERTIFICATION

List of Growers, 1949

By W. A. Downie, B.Agr.Sc., Agricultural Research Officer

A LIST of growers of seed potatoes, whose crops have been inspected at least twice in the field and conform to the standard of purity and freedom from disease required under the Seed Potato Certification Scheme, is appended. The produce of these crops may be sold as "Certified" seed, provided the tubers comply with the Grade Standard for seed potatoes and are contained in sealed bags bearing an official label.

In previous years, mention has been made of the disease, Bacterial Wilt. During the current season, conditions have been particularly favorable for the multiplication and spread of the causal organism (*Bacterium solonaccarum*). As a result, many growers whose crops normally achieve the standards required, are this year not included in the list.

Evidence is accumulating that the varieties Sebago and Sequoia offer little or no resistance to this disease. The only practicable method for control is to plant clean seed in clean land. With this, seed-potato growers must combine rigid sanitation practices designed to prevent the introduction of the disease. Any grower who is not conversant with these practices is advised to communicate with the Biological Branch, Department of Agriculture, Burnley Gardens, Burnley.

Growers in the Central Highlands fall into a different category from those in other areas. In that area the incidence of Bacterial Wilt, plus the virus disease Spotted Wilt, is threatening the future certification of all varieties except Snowflake.

The planting of a portion of the area submitted by the tuber-unit method has already shown substantial results. This method of planting is an essential feature of the Seed Potato Certification Scheme and growers are reminded that they are expected to plant a *minimum* of one bag of each variety submitted as tuber units.

Sebago and Sequoia crops will be subject to further examination before being finally certified.

LIST OF GROWERS OF PROVISIONALLY CERTIFIED SEED POTATOES, 1949

Name.	Address.	Acres.
EARLY CARMAN.		
Allan, J. M. and R. ..	Whelan's L.B., via Leongatha	7
Kuhne, C. J. ..	McKinnon's P.O., via Leongatha	5
Milnes, F. B. ..	"Woorara Park," Nichol's-road, via Leongatha	2
Morter, H. and T. ..	Leongatha	7
McGrath, W. J., and Sons	Stony Creek	7
McKenzie, I. N. ..	Whelan's P.O., via Leongatha	3
Powell, H., and Sons	Thorpdale	15
White, J., and Son ..	"Elnaam," Neerim ..	¾
Wilson, I. W. ..	Neerim Junction	2
LATE CARMAN.		
Butler, J.	Weeaproinah, via Colac ..	½
Congram, W. J. P. ..	Beech Forest, via Colac ..	3
Exton, Chas., and Sons	Kinglake Central, via Whittlesea	42
Francis, A. L. ..	Weeaproinah, via Colac ..	1¼
Francis, J. E. ..	Ferguson P.O., via Colac ..	7
Haney, D. W. ..	Kinglake, via Whittlesea ..	5
Minchinton, E. A., and Son	Weeaproinah, via Colac ..	9
Minchinton, E. F., and Son	Beech Forest, via Colac ..	3
McMahon, J. P. ..	Kinglake, via Whittlesea ..	6
Reeves, S. A. ..	Kinglake, via Whittlesea ..	10
Towers, A. J. ..	Beech Forest, via Colac ..	9
White, J., and Son ..	"Elnaam," Neerim ..	¼
Young, A. E. ..	Beech Forest, via Colac ..	3
KATAHDIN.		
Collery, John ..	Hesket P.O., via Woodend ..	12
Dyer, M. H. ..	Gembrook	9
Knox, J., and Son ..	Weeaproinah, via Colac ..	7
McGrath, W. J., and Sons	Stony Creek	5
McKenzie, A. ..	Wyelangta, via Colac ..	3
Sale, V. J.	Gladysdale	13
Sinclair, E. S. ..	"Avondale," Stony Creek ..	3
Stielow Bros. ..	Gembrook	8½
Stielow, I.	Gembrook P.O.	10
UP-TO-DATE.		
Anderson, W. and W. J.	Banool, via Colac	2
Baulch, S. G. ..	Beech Forest, via Colac ..	8½
Brown, C. F. ..	Wyelangta, via Colac ..	1
Cashin Bros. ..	Ferguson, via Colac ..	2
Congram, W. J. P. ..	Beech Forest, via Colac ..	15
Deppeler Bros. ..	Beech Forest, via Colac ..	5
Minchinton, E. F., and Son	Beech Forest, via Colac ..	14

List of Growers of Provisionally Certified Seed Potatoes, 1949—*continued.*

Name.	Address.	Acres.
UP-TO-DATE—*continued.*		
Murchison, A. M. J.	Ferguson, via Colac	17
Pappin, A.	"Fairview," Ferguson, via Colac	4
Simmons, J. C.	Wyelangta, via Colac	2
Tann, W. H.	Weeaproinah, via Colac	3
Young, A. E.	Beech Forest, via Colac	1
SEBAGO.		
Amey, L.	Jindivick	4
Baulch, R. M. and H. J.	Stalker, via Colac	4
Berryman, F. J.	c/o Mrs. F. Drury, Thorpdale	9
Butler, J.	Weeaproinah, via Colac	8
Chapman, L. J.	Lardner-road, Warragul	4
Ciancio Bros.	Wylangta, via Colac	2
Congram, W. J. P.	Beech Forest, via Colac	6
Cook, L.	Amey's-track, Foster	½
Dyer, M. H.	Gembrook	6
Edwards, A.	Ferguson, via Colac	7
Ewart, J. H. M.	Hoddle's Creek	1½
Exton, Chas., and Son	Kinglake Central, via Whittlesea	6½
Francis, A. L.	Weeaproinah, via Colac	1½
Francis, J. E.	Ferguson P.O., via Colac	4
Genoni, A. F.	Jindivick	1
Grosse, H. G.	Beech Forest, via Colac	17
Hawkins, E. T.	Kinglake, via Whittlesea	7
Hobson, J. T.	Laver's Hill, via Colac	5
Jones Bros.	"Fair View," Fish Creek	8
Kelly, C.	Gembrook	1
Knox, J., and Son	Weeaproinah, via Colac	16
McGrath, W. J., and Sons	Stony Creek	8
McKenzie, A.	Wyelangta, via Colac	5
McMahon, J. P.	Kinglake, via Whittlesea	2
Owen, F. J., and Sons	Pleasant Creek, via Whittlesea	12
Powell, H., and Sons	Thorpdale	6
Pretty, A.	Kinglake Central, via Whittlesea	5
Puls, A. B.	Beech Forest, via Colac	10
Shackleton, H. G.	Thorpdale	6½
Sinclair, E. S.	"Avondale," Stony Creek	10
Thom, J. R.	Kinglake Central, via Whittlesea	6
Taylor, T. V. and R. C.	Gembrook - road, Hoddle's Creek	½
White, J., and Son	"Elnaam," Neerim	11
White, R. T.	13 Bair-street, Leongatha	3
Wilson, I. W.	Neerim Junction	4
Young, A. E.	Beech Forest, via Colac	2

Name.	Address.	Acres.
*** SEQUOIA.**		
Amey, L.	Jindivick	3
Baulch, R. M. and H. J.	Stalker, via Colac	1½
Brown, D. B.	Wyelangta, via Colac	½
Cabin Bros.	Ferguson, via Colac	½
Congram, W. J. P.	Beech Forest, via Colac	1
Dyer, M. H.	Gembrook	½
Eades, W. H.	Thorpdale South	½
Ebbels, J. T.	Olinda P.O.	½
Exton, Chas., and Sons	Kinglake, via Whittlesea	½
Francis, J. E.	Ferguson P.O., via Colac	½
Frost, E. T.	Stony Creek	½
Grosse, H. G.	Beech Forest, via Colac	½
Hawkins, E. T.	Kinglake, via Whittlesea	½
Kelly, C.	Gembrook	½
Morter, H. and T.	Leongatha	1
McGrath, W. J., and Sons	Stony Creek	½
McKenzie, A.	Wyelangta, via Colac	½
McKenzie, I. N.	Whelan's P.O., via Leongatha	½
Owen, F. J., and Sons	Pheasant Creek, via Whittlesea	½
Shackleton, H. G.	Thorpdale	½
Sinclair, E. S.	"Avondale," Stony Creek	½
Stielow Bros.	Gembrook	½
Tann, W. H.	Weeaproinah, via Colac	½
Thom, J. R.	Kinglake, via Whittlesea	½
Toohey, L. F. and T. J.	Kinglake, via Whittlesea	½
White, J., and Son	"Elnaam," Neerim	½
White, R. T.	13 Bair-street, Leongatha	1
Willis, A. T.	Hoddle's Creek	½
Wilson, I. W.	Neerim Junction	1
SNOWFLAKE.		
Boadle, L. H.	Claretown, via Ballarat	15
Gooch Bros.	Wheatsheaf P.O., via Daylesford	10
Labbett Bros.	Clark's Hill P.O., via Ballarat	6
Pretty, A.	Kinglake Central, via Whittlesea	5
White, J., and Son	"Elnaam," via Neerim	½
† EXTON.		
Exton, Chas., and Sons	Kinglake, via Whittlesea	22

* Growers with less than 1 acre of Sequoia are unlikely to have any surplus of seed available for sale.

† Exton, a new variety developed by Mr. C. Exton Senr., is a seedling from Katahdin. It is a late variety, with thick, oval tubers and has performed well in some districts.

Class for Herd Testers

A class for the instruction of Herd Testers will be conducted by the Department of Agriculture at the School of Primary Agriculture, Burnley, commencing on 23rd May, 1949. At the conclusion of the class, an examination for the Herd Testers' Certificate of Competency will be held on the 8th, 9th, and 10th June, 1949. No charge will be made for tuition, but the class will be limited to such persons who intend to take up herd-testing work. Instruction will be given in the following subjects :—

The principles of milk testing.

The practice and principles of the Babcock test.

Rules governing the Association system of testing.

Herd test recording work and the preparation of herd test returns.

At present twenty vacancies exist for qualified testers.

Further information may be obtained on application to the Superintendent of Dairying Department of Agriculture, Melbourne, C.2.

Diseases Affecting Young Cattle

SCOURS, RINGWORM, BLACKLEG

By A. R. GRAYSON, B.V.Sc.,
Senior Veterinary Officer

ANY disease affecting young cattle, and resulting either in death or unthriftiness, represents a serious economic loss to both the individual owner and the community. Where death does not occur, the time and labour involved in nursing and treating the sick animal represents a serious drain on the limited labour available. These disease conditions however can often be controlled by attention to hygiene, and in some cases disease can be prevented by calfhood immunization. This latter method, in particular, is strongly recommended, representing a direct financial saving, as well as a saving of labour.

SCOURS IN CALVES

1. "*White Scours.*"—The term "white scours" indicates the chief symptom of a serious disease in young calves, which is common in the dairy herds of this State. It is a form of diarrhoea occurring usually within two or three weeks after birth, and is due to organisms of the Colon type. Infection usually takes place by way of the mouth, but an unhealed navel may afford a means of entrance. The disease runs a fairly rapid course, and is fatal in a large percentage of cases. In some instances, where recovery does occur, secondary infection, i.e., arthritis, may arise. Surviving animals remain weak and stunted for a considerable time.

Symptoms may occur within a short time after birth, or may not develop for ten or twelve days. A very profuse liquid diarrhoea is set up, generally yellowish-white in colour, often curdy or frothy, and sometimes blood-stained. The faeces are generally offensive in odour, and their passage is accompanied by straining, grunting or moaning. Emaciation is rapid. The tail region becomes badly soiled, and the calf presents a miserable picture; eyes sunken, belly tucked up, back arched, hair stiff and dry. The temperature is raised early, but as the condition progresses the temperature may become sub-normal, as evidenced by a coldness of the extremities.

2. "*Blood Scours.*"—In older calves, diarrhoea with foetid blood-stained faeces may develop. This condition is commonly known as "blood scours" and is due to enteritis caused by bacterial infection. As the condition develops, a picture resembling that described above is presented.

Treatment

Treatment consists first in the isolation of the sick calf to prevent the spread of infection. It should be placed in clean, bright, well-drained and well-ventilated, dry surroundings, or in a sheltered, well-drained yard or paddock. All food should be withheld for one or two days, and a liberal supply of cooled boiled water given every

four hours. In some milder cases, this will be sufficient to remove the irritating material causing the diarrhoea, and recovery occurs. In other cases, particularly in older calves, it is advisable to dose with castor oil (1 to 3 oz. according to the size of the calf) in an attempt to remove the irritating material, which often consists of undigested clots of milk. This should be followed with an internal antiseptic. Perhaps the best to use would be formalin, which, besides being an intestinal disinfectant, also prevents bloating. The dose according to size is ½ to 1 teaspoonful given in ½ pint of boiled milk. This can be repeated daily. If the diarrhoea still persists, astringents such as bismuth subnitrate 1 dram, gum arabic 1 dram in boiled milk given three times daily, *or* powdered opium 5 grains, catechu 1 dram, and prepared chalk 1 ounce, given in gruel twice daily, may be administered.

Sulphonamide Treatment

Certain members of the sulphanilamide group of drugs are highly efficient in controlling calf scours. In order of preference these are sulphamezathine, sulphamerazine and sulphaguanidine. Of the first two, an initial dose of 2 drams (16 half gramme tablets) per 60 lb. bodyweight is given, followed by a dram (8 half gramme tablets) per 60 lb. bodyweight given once every 24 hours.

The tablets are first crushed, and the resulting powder may be incorporated with the food or be given as an electuary with treacle or honey.

Sulphaguanidine for veterinary use is prepared commercially as a pink powder. The initial dose for calves is 3½ grammes (1 level teaspoon and a half) per 50 lb. body weight, followed by 2½ grammes (1 level teaspoon) per 50 lb. body weight, then 2 grammes at 6-hourly intervals until the scouring subsides.

With any treatment, it is important that the patient have access to an adequate clean water supply.

Prevention

Prevention, however, provides a much better line of defence than does curative treatment, and is more likely to yield better results. It consists in the first place in care and attention at the actual time of calving. In this respect, under Australian conditions, good clean pasture will provide the necessary hygienic surroundings.

On properties where the disease is known to exist, the navel of the calf should be ligatured and disinfected with tincture of iodine at birth or as soon after as possible. The most important line of control, however, is the care which must be given to the nutrition of the newly born calf. It requires, and should get, its own mother's milk for at least the first few days. This first milk or colostrum has laxative properties, and, in addition, contains elements which assist the calf in resisting disease during its early life. Not the least important of these elements is the relatively high vitamin A content. Whole milk should be fed for the next few weeks. Separated milk should not be fed to the calf until it is three to four weeks old. The change from new to separated milk should be gradual, and a substitute for the cream removed by the separator should be provided. For this purpose 1 to 2 oz. daily of pure cod liver oil is probably the best. If cod liver oil is not obtainable, the use of Apsolene or other similar fish-liver product will prove satisfactory. The calf should not be over fed, and all milk should be fed at blood heat. More care in the frequency and amount of the feeds will do much to prevent digestive disorders. All feeding buckets should be scalded after each meal and preferably hung up in the open, exposed to sunlight.

The newly-born calf is susceptible to cold, and this necessitates the provision of adequate shelter. This usually takes the form of more or less permanent calf sheds and pens.

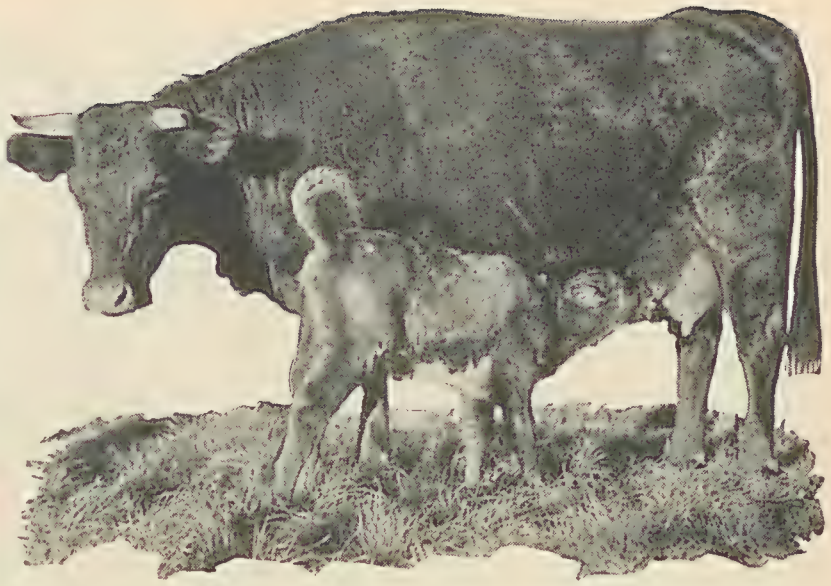
Essential points to be considered in the construction of calf sheds are :—

1. They should be bright, airy and dry.
2. An impervious floor is essential, and the floor must be given sufficient fall for drainage. Disinfection and general cleanliness are thus rendered easier.
3. Plenty of bedding to provide a warm, dry bed in winter and a cool one in summer should be provided, and soiled bedding must be replaced regularly and frequently.

Calf pens or yards should be sufficiently roomy to provide plenty of exercise. They must be located so that they are not contaminated by drainage from other paddocks or existing sheds, i.e., cow sheds, pig sties, &c. The provision of a feeding rack to contain

good quality meadow hay is desirable as this will tend to obviate any tendency to eat bedding. There should be a readily accessible supply of good fresh water.

Minerals are necessary for all growing animals, and milk alone, particularly when separated, does not contain a sufficiency of minerals for normal growth and development. To a large extent any mineral deficiency is overcome when the calf starts feeding on pasture, and this will be further aided by the provision of a suitable mineral lick such as dicalcic phosphate, bone meal or bone flour 1 part to salt 4 parts. While being bucket fed, the addition of limewater to the milk at the rate of 1 dessertspoonful to 1 quart is of distinct advantage. Carron oil, which is made by mixing equal parts of limewater and raw linseed oil, may also be used.



The newly-born calf should get its own mother's milk for the first few days.

It must be stressed that calves are born healthy, and that the relatively high rate of mortality is due, fundamentally, to errors in feeding and management, and, as such, are preventable. This particularly applies to "scours" for outbreaks are intensified under conditions of bad management.

RINGWORM IN CALVES

Ringworm is a disease of the skin which may attack any domesticated animal, and also man. It is most frequently seen in young animals such as calves or yearlings which are in poor condition. The disease is contagious, and is caused by fungi of the family *Trichophyta*. These fungi consist of growing threads or hyphae, and have the powers of forming spores which are very resistant and may retain their power of germination for months.

Infection results usually from direct contact of healthy with affected animals, or it may occur in sheds or pastures through the medium of posts, &c., against which affected animals have rubbed themselves.

Lesions most commonly occur about the head, face and lips, eyelids and neck, although they may be found on any part of the body. The lesion commences as a raised ring-like patch on which the hair becomes at first erect, and later breaks off. This is due to the fungus becoming established at the base of the hairs. As a result of its penetration, epithelial scales become heaped up to form greyish-white or greyish-yellow crusts. The lesions are usually numerous and extend to the size of a five-shilling piece. They may become confluent, in which case quite large areas are involved. These crusts are at first firmly adherent, and, if forcibly removed leave a raw bleeding surface. If left alone, the crust becomes raised by a slight purulent discharge, and may later be shed. The bare skin then exposed has a thickened and wrinkled appearance. The discharge on the bare patch often dries and forms a thin scab under which healing takes place, followed by a subsequent growth of new hair.

In adult cattle there is, as a rule, no systemic disturbance, but in badly affected young stock, general unthriftiness is set up. The degree of irritation is variable, but in the majority of cases calves tend to rub themselves against gate posts and other obstacles, and thus set up centres of infection and re-infection. So, through lack of attention, ringworm may assume a chronic character.

Treatment

Affected animals should be isolated. Calf pens, &c., from which affected animals have been taken should be thoroughly disinfected, particular attention being paid to the woodwork. Lime-wash containing carbolic acid, ½ pint to the gallon, may be used, and is most effective if applied hot.

Curative treatment in most cases is both simple and effective. The hair should be clipped from around the affected parts, and the crusts and scales removed. This may be done more easily if they are first softened by applications of olive oil. They may then be washed off with warm soapy water to which washing soda has been added. All debris removed should be carefully burnt.

Having cleaned up the affected parts and dried them, the lesions must be dressed with a parasiticide, of which there is a considerable choice. Probably ordinary weak tincture of iodine (2½ per cent.) makes the best dressing. Other suitable dressings are—equal parts of sulphurous acid and glycerine; 1 part creosote to 7 parts raw linseed oil; 2 per cent. solution of formalin in water. Mercuric preparations such as mercuric ointment or corrosive sublimate are also very effective. These should not, however, be applied over large areas as calves are liable to be poisoned by mercury. Whatever method of treatment is adopted, it is important to remember—

1. That all diseased hair must first be shed or removed.
2. That a liberal diet is necessary.
3. That man can contract this disease from cattle. The attendant, therefore, should wear overalls while dressing an animal, and should disinfect his hands and arms afterwards.

BLACKLEG IN CATTLE

Blackleg is an acute infectious disease affecting, chiefly, cattle between the ages of six months and two years. Younger and older cattle however, may be affected, and sheep of all ages are also susceptible. The disease is more or less restricted to certain well-defined areas. Even in these areas the infection may be restricted to certain portions or even paddocks. River flats, low-lying pastures or swamps, &c., are often particularly dangerous.

Blackleg is caused by a bacillus—*clostridium chauvei*—which is an anaerobe; that is, it cannot exist in the presence of oxygen. The bacillus has the power of forming spores and these spores can remain viable for years. Contamination of pastures is greatly increased when infected carcasses are cut up or are not properly disposed of.

Animals do not infect each other directly, but pick up the infection from the soil, either by swallowing infected food or water, or by contamination of a wound.

Symptoms

The period of incubation is usually about three days, and the disease runs a rapid course, death ensuing in from 12–48 hours. In many cases, no symptoms are noticed, the infected animal being found dead. When symptoms are seen, a sick animal often shows a lameness generally restricted to one hind leg. The animal separates itself from the rest of the herd, refuses to feed, and rumination ceases. The temperature is raised, being from 104 to 107 degrees, and the animal goes down. There is a blowing respiration often accompanied by grunting. On close inspection, a local swelling may be discovered—most often in the upper part of the hind limb in which lameness was apparent. This swelling, however, may appear wherever there is a muscular mass, ie., in shoulders, loins, chest, neck, &c. It is at first small, hot and painful, but rapidly extends, involving a larger area. Later the swelling becomes cold and insensitive. The skin in the area becomes hard and dry, and there is often a sharp line of demarcation between the diseased and healthy tissues. On manipulation, the swelling is found to be gas-filled and a peculiar crackling sound like the rustling of stiff paper is heard. This is due to the presence of gas in the swelling, the gas being formed in the tissues by the causal bacillus. As the condition progresses, the breathing becomes more laboured, the animal becomes prostrate, the temperature falls to normal or sub-normal, and death soon follows.

Post-Mortem Lesions

The characteristic lesion of blackleg is the gas-filled swelling which crackles on manipulation. If the lesion is cut, the muscles and other tissues are found to be dark red or black in colour, and more or less porous and dry-looking. This is due to the separation of the muscle fibres by the gas formation. The affected tissues give

A nice group of healthy young dairy heifers.

off a characteristic odour resembling rancid butter. A blood-stained discharge is given off when the muscle fibres are cut, and sometimes there are similar discharges in the pleural and abdominal cavities.

The frequent occurrence of the swelling in the upper portion of a limb has given to the disease the name " Blackleg " or " Black quarter." Occasionally, however, no external evidence of swelling is noticed, the lesion in these cases being found elsewhere in the carcass.

Treatment and Prevention

Curative treatment is useless. Any attempt at such, by incision of the affected portion and the application of strong disinfectants, is to be condemned because of the certainty of spreading organisms which are very abundant in the liquid escaping from the cut surfaces.

As the spores of the organism can live in the soil, great care must be taken, as already indicated, to prevent any addition to the number already in the soil. Carcasses should not be skinned or unnecessarily cut up, but should be disposed of by complete burning. Cattle of susceptible age should be kept off known infected pastures and periodical burning of these infected pastures is a further method of prevention.

Vaccination

The only effective method of preventing the disease is by vaccinating calves before they reach the susceptible age, and the Commonwealth Serum Laboratories prepare a vaccine which is recommended for this purpose. It contains no living organisms, therefore it is quite safe, and it confers an immunity which persists during the susceptible period. A permit to obtain the vaccine will be supplied on application to the stock inspector of the district, and the inoculation, which consists of the injection of the vaccine (under the skin) can be carried out by the farmer himself. The usual precaution of clipping the hair and sterilizing the skin with tincture of iodine or methylated spirits before injection should be observed. The inoculation is made usually behind the shoulder.

A suitable hypodermic syringe and needle, with care, will last for years, so that the only expense each year is the cost of the vaccine itself.

Blackleg is a notifiable disease under the Stock Diseases Act, and all outbreaks should be reported to the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

All sudden deaths among young cattle, associated with lameness and the characteristic crackling swelling in the muscles of the limbs should cause stock owners to suspect blackleg. In suspicious cases, in order that the diagnosis may be confirmed, a portion of the affected muscle—about 2 inches in diameter—should be placed in a screw-top jar, and this, securely packed, forwarded to the Director, Veterinary Research Institute, Parkville, N.2. A letter advising the despatch of the specimen for diagnosis and describing symptoms noticed, should be forwarded at the same time.

APPROVED SEED POTATOES

List of Growers, 1949

By W. A. Downie, B.Agr.Sc., Agricultural Research Officer

APPROVED seed potatoes are the produce of crops located in the main potato-growing districts which were planted with "certified" seed and which at flowering time showed no more than 7 per cent. of undesirable plants.

It is stressed, however, that approved seed should not be confused with "certified" seed. The latter, which conforms to a much higher standard of purity and freedom from disease, is only marketed in sealed bags carrying the official label of the Department of Agriculture. A list of growers of "certified" seed potatoes appears elsewhere in this issue.

Name and Address of Grower.	Acreage.	Tonnage Approved.
VARIETY—EARLY CARMAN.		
Coulter, W. J. and R. I., McKinnons P.O., via Leongatha	1½	6
VARIETY—LATE CARMAN.		
Brady, E. J., Pheasant Creek, via Whittlesea	10	40
Brauer, W. C., Beech Forest, via Colac ..	4	20
Ebbels, J. T., Olinda	7	28
Grimwood, R., and Son, Laver's Hill, via Colac	6	30
Meehan, B. P., Webster's Hill, via Colac ..	2	10
Mossop, E. M. and W. R., East-street, Daylesford	20	60
Murchison, A. M. J., Ferguson, via Colac ..	10	50
McCann, S. M., Ferguson, via Colac ..	10	50
Parker, S., Webster's Hill, via Colac ..	2	10
Pearce, V. A., Webster's Hill, via Colac ..	3	15
Simmons, J. C., Wyelangta, via Colac ..	2	10
Skinner, F. T., Ferguson, via Colac ..	4	20
Thom, J. R., Kinglake, via Whittlesea ..	8	32
Toohey, T. J., Kinglake, via Whittlesea ..	8	32
Trewhella, Miss C. A., Trentham	8	32
Ware, W. E., Jumbunna	1½	8
VARIETY—UP-TO-DATE.		
Butler, J., Weeaproinah, via Colac	½	2
Cartiere, G., Wyelangta, via Colac	5	25
McMinn, H. G., Wyelangta, via Colac ..	8	40
Skinner, F. T., Ferguson, via Colac ..	5	25
Westbury, V. R., Wyelangta, via Colac ..	9	45
VARIETY—KATAHDIN.		
Boustead, A. C., Dean, via Ballarat ..	5	15
Breen, J. P., "Hazeldean," Gembrook ..	6	24
Butler, J., Weeaproinah, via Colac ..	½	2
Child, G. H., "Hemlock," Gembrook ..	2	8
Collery, Jas., Kerrie, via Romsey	13	39
Dye, A., Gilwell Park-road, Gembrook ..	5½	22
Exton, Chas., and Sons, Kinglake Central, via Whittlesea	12	48
Ure, A. W., Gembrook	10	40
Wilson, I. W., Neerim Junction	2	8
VARIETY—SEBAGO.		
Anderson, W. and W. J., Banool, via Colac	2	10
Benson, W. A., McDevitt, via Colac ..	4	20
Berg, H. F., Box 5, Trentham	8½	26
Berg, W. A., Trentham	4	12
Boadle, L. H., Claretown, via Ballarat ..	6	18
Boustead, A. C., Dean, via Ballarat ..	15	45
Boustead, G. and I., Dean, via Ballarat ..	17	51
Brown, C. F., Wyelangta, via Colac ..	8	40
Brown, D. B., Wyelangta, via Colac ..	10½	52
Cartiere, G., Wyelangta, via Colac	10	50
Cashin Bros., Ferguson, via Colac	6	30
Collery, Jas., Kerrie, via Romsey	1½	5

Name and Address of Grower.	Acreage.	Tonnage Approved.
VARIETY—SEBAGO—*continued.*		
Collery, John, Hesket, via Woodend ..	1	3
Deppeler Bros., Beech Forest, via Colac ..	15	75
Dow, R. and W., Ferguson, via Colac ..	17	85
Dye, A., Gilwell Park-road, Gembrook ..	2	8
Eades, W. H., Thorpdale South	8	32
Fenn, W. T., Yuulong, via Colac	3	15
Fry, R. J., Laver's Hill, via Colac ..	8	40
Gass, J., Beech Forest, via Colac	6	30
Gooch Bros., Wheatsheaf P.O., via Daylesford	20	60
Gordon, A. and C., Weeaproinah, via Colac	12	60
Graham, D. J., Thorpdale	9	36
Hansen, H. T., Ferguson, via Colac ..	7	35
Jarvie, R., Kinglake West, via Whittlesea ..	½	2
Jones, A. R., "Treforest," Warragul ..	25	100
Labbett Bros., Clark's Hill, via Ballarat ..	12	36
Meehan, B. P., Webster's Hill, via Colac ..	2	10
Minchinton Bros., Ferguson, via Colac ..	31	155
Minchinton, E. A., and Son, Weeaproinah, via Colac	15	75
Minchinton, E. F., and Son, Beech Forest, via Colac	9	45
McCann, S. M., Ferguson, via Colac ..	5	25
Pearce, V. A., Webster's Hill, via Colac ..	2	10
Perry, J. A., Beech Forest, via Colac ..	7	35
Renzella, V. A., Weeaproinah, via Colac ..	4	20
Simmons, G. J., Wyelangta, via Colac ..	6	30
Skinner, F. T., Ferguson, via Colac ..	6	30
Suckling, T., Clark's Hill, via Ballarat ..	9	27
Tibbits, J. M., Wyelangta, via Colac ..	2	10
Toohey, J., Kinglake West, via Whittlesea ..	10	40
Toohey, T. J., Kinglake, via Whittlesea ..	12	48
Willis, A. T., Hoddle's Creek	8	24
Young, R. and A., Weeaproinah, via Colac ..	4	20
VARIETY—SEQUOIA.		
Boadle, L. H., Claretown, via Ballarat ..	½	2
Boustead, A. C., Dean, via Ballarat ..	10	40
Butler, J., Weeaproinah, via Colac ..	½	2
Collery, Jas., Kerrie, via Romsey	½	2
Collery, John, Hesket P.O., via Woodend ..	½	2
Dow, R. and W., Ferguson, via Colac ..	½	2
Gooch Bros., Wheatsheaf, via Daylesford ..	½	2
Gordon, A. and C., Weeaproinah, via Colac	½	2
Grimwood, R. and Son., Laver's Hill, via Colac	½	2
Jones, A. R., "Treforest," Warragul ..	½	2
Knox, J., and Son, Weeaproinah, via Colac	5	25
Labbett Bros., Clark's Hill, via Ballarat ..	1	4
Minchinton, E. A., and Son, Beech Forest, via Colac	1	5
Minchinton, E. F., and Son, Beech Forest, via Colac	½	2
Powell, H., and Sons, Thorpdale	1	4
Skinner, F. T., Ferguson, via Colac ..	½	2
Toomey Bros., Trentham	1	4
Young, R. and A., Weeaproinah, via Colac ..	½	2

REGISTRATION OF STALLIONS

Twenty-Ninth Annual Report

R. J. deC. Talbot, B.V.Sc., Chief Veterinary Inspector

REVIEWING the operations of the Horse Breeding Act for the year 1948–49, it is revealed that a total of 869 stallions were registered under the Act, an increase of 33 over the number registered for the previous year. Of the total, 227 were draughts, 279 light, and 363 pony stallions.

The number of stallions examined by the veterinary staff with a view to registration was 377, comprising 54 draughts, 106 light, and 217 ponies, and of these 35 (9·28 per cent.) were refused registration because of unsoundness and 42 (11·14 per cent.) because they were considered to be below a reasonable standard in respect of type and conformation.

Three hundred stallions were passed for registration, which is an increase of 50 over the previous year, but light and pony stallions are largely responsible for this as only two more draught stallions were examined than in 1947–48. The heavy-horse industry has been declining since 1939 and this year the number of draught stallions registered, 227, is the lowest since that year.

TWO-YEAR-OLD COLTS

The amending Horse Breeding Act now provides for the registration of two-year-old colts, the owners of which desire to use them for service. Owners must make application for registration on the prescribed form and such application must be accompanied by a fee of £1. The colts must be submitted for examination by a veterinary officer and if passed will be registered as colts for one year.

During the year under review thirteen colts were examined of which eight were certificated.

EXAMINATION OF MARES

Breeders are reminded that, under a voluntary scheme, stud-book mares may be submitted for examination for soundness. A fee of £1 is charged for the examination and certificates for soundness are issued for three-year-olds and for four-year-olds, and life certificates for mares over five years.

In the past, many owners have availed themselves of the opportunity of having their mares examined and it is hoped that during the coming season stud breeders will present at least some of their mares for examination.

FOAL BONUS

In 1941, with a view to encouraging the breeding of the best type of draught stock, the Victorian Government decided that a bonus of £2 would be paid to the owners of every foal the progeny of a registered draught stallion and a mare approved by the Chief Veterinary Inspector. In 1946 it was decided to increase the bonus to £4.

Application for the foal bonus should be made to the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

APPEALS

During the year there was one appeal against decisions of examining veterinary officers and this was dismissed by the Appeal Board.

PARADES FOR THE COMING SEASON

A schedule of parades is not being arranged for this season. Where possible, arrangements will be made to examine stallions at centres most convenient to those owners from whom applications have been received. Applicants should state which main town would be suitable for them to present their stallions for examination and they will, in due course, be advised of the date, time, and place, arranged for the examination.

Provided owners forward their applications by the 1st July as required it is felt that, by such an arrangement, every stallion will be examined before the commencement of the breeding season.

Applications for registration must be made on the prescribed forms before the 1st July and must be accompanied by a fee of £1 10s. (£1 for registration and 10s. for compensation fee) in respect of stallions fifteen years of

LIST OF UNREGISTERED STALLIONS RETAINED BY OWNERS FOR USE WITH THEIR OWN MARES.

Under the provisions of the Horse Breeding Acts, the owner of any stallion, the registration of which has been refused, may, on payment of a fee of £1 per annum, and notification to the Chief Veterinary Inspector, retain such stallion for use with his own mares only.

Name.	*Age and Class.	Owner and Address.
Acklom	4 P.	J. R. Smith, Cobains, via Sale
Allendale	5 L.	A. Funcke, Minyip
Barney	A. L.	H. H. Lewis, Tatong
Benambra	A. D.	Nankervis Bros., Corryong
Black Mac	5 P.	A. I. Blair, Bright
Black McGregor	6 L.	C. F. Ward, Picnic-road, Ararat
Black Prince	A. P.	W. K. Thomas, Mt. Cole Creek
Black Star	A. L.	D. Madill, Koyuga South
Blue Boy	3 L.	I. Grant, Cudgee
Bob	5 D.	O. G. Bramich, Terang
Boy Caledon	A. T.	Naughton Bros., Omeo
Brilliant Steel	A. T.	G. Austin, Junr., Bay-street, Frankston
Dandy	5 P.	A. F. Keiller, Allestree
Danny Boy	A. L.	W. Meagher, Danyo
Duke Fort	A. D.	G. E. Casey, c/o P.O., Jung
Ethalldale	A. D.	H. Kramer, Lawloit
Farleton Carry On	3 D.	J. S. Wall, Earlston
Feather View Flash Duke	4 D.	Bartlett, T. G. Gerang Gerung
Flash	A. P.	A. F. Saunders, Sale
Golden Glory	5 P.	D. W. Battarbee, Warrnambool
Goldie	6 P.	J. L. Sullivan, Whitelaw
Heathermount Baron	3 D.	A. Bransgrove, Neerim Junction
John McElwyn	A. P.	D. Bamford, Beeac
Kennerty Strathmate	A. D.	A. T. Ward, Meringur
King Henty	4 L.	C. Nolte, "Whernside," Merino
Ko Warra Robert	A. D.	R. S. Smith (Estate), Echuca
La-De-Da	A. L.	Beryl Trewern, Lantana-street Ivanhoe
Little Prince	A. P.	G. E. Clarke, Bulla
Lord Victor	A. D.	J. Montgomery, Milawa
Marcovitch	A. P.	T. Spong, 83 Bloomfield-road, Ascot Vale
Model	A. D.	G. B. Wilson, Timboon
Naseby Dene	4 D.	R. W. Adams, Rosebud
Naseby Materspiece	4 D.	J. Bryant and Sons, Bet Bet
North Lyn	5 P.	F. S. Tindall, Notting Hill
Parkly Peter	A. L.	S. S. Moulten, Newry
Patches	A. P.	G. E. Clarke, Bulla
Ranger	4 P.	S. J. Clarke, Glenormiston South
Royal Beatty	4 L.	C. Nolte, "Whernside," Merino
Satin Again	3 L.	F. G. Rinaldi, Sale
Sinbad	3 P.	G. English, Langville
Skipper	3 D.	A. H. Dickinson, Broughton, via Nhill
Skylark	A. P.	J. Skehan, Sale
Smart Lad	6 T.	H. Dunbar, Traralgon
Star Bruno	4 L.	P. Dunstan, Swan Hill
Sylvester Ronald	A. D.	T. Parker, Boort
Smokey	3 D.	B. Lawrence, Lockington
The Vanquisher	A. T.	E. J. Gleeson (Estate), Macarthur
Twilight	4 P.	F. Lovell, Ararat
Viewport the First	4 P.	H. A. Lincoln, Portarlington
Wee Jackie	4 P.	A. B. Cecini, St. Arnaud
Unnamed	A. L.	J. J. Cleland, Mulwala, N.S.W.
Unnamed	A. L.	W. Pearson, Creighton's Creek

* NOTE.—Age in years. A. aged; D. draught; L. light P. pony; T. thoroughbred.

age and under, and a fee of £1 1s. in respect of stallions sixteen years or over sixteen years. The necessary forms may be obtained from the Chief Veterinary Inspector, Live Stock Division, Department of Agriculture, Melbourne, C.2.

Changes of ownership must be notified without delay so that certificates of registration can be endorsed accordingly. Registration expires within 30 days of change of ownership unless the required notice is given.

SUMMARY OF STALLION EXAMINATIONS, 1948-49.

	Draught.		Light.		Pony.		Total.	
	Examined. 54.	Certificated. 35.	Examined. 106.	Certificated. 80.	Examined. 217.	Certificated. 185.	Examined. 377.	Certificated. 300.
	Rejected.	Percentage Rejected.	Rejected.	Percentage Rejected.	Rejected.	Percentage Rejected.	Rejected.	Percentage Rejected.
Bone Spavin	1	1·85	5	4·71	10	4·61	16	4·24
Bog Spavin	1	1·85	1	0·94	1	0·46	3	0·79
Ringbone	2	3·70	3	2·83	3	1·38	8	2·12
Sidebone	4	7·41	..	..	..	..	4	1·06
Curb	..	..	2	1·89	..	..	2	0·53
Stringhalt	1	1·85	..	..	..	..	1	0·27
Nasal Disease ..	..	..	..	..	1	0·46	1	0·27
Unsoundness ..	9	16·66	11	10·37	15	6·91	35	9·28
Disapproval	10	18·51	15	14·15	17	7·83	42	11·14
Total ..	19	35·17	26	24·52	32	14·74	77	20·42

SUMMARY OF STALLION EXAMINATIONS, 1947-48.

	Draught.		Light.		Pony.		Total.	
	Examined. 51.	Certificated. 33.	Examined. 99.	Certificated. 78.	Examined. 155.	Certificated. 139.	Examined. 305.	Certificated. 250.
	Rejected.	Percentage Rejected.	Rejected.	Percentage Rejected.	Rejected.	Percentage Rejected.	Rejected.	Percentage Rejected.
Bone Spavin	1	1·96	5	5·05	4	2·58	10	3·278
Bog Spavin	1	1·96	1	1·01	..	..	2	0·655
Ringbone	3	5·88	..	..	2	1·29	5	1·639
Sidebone	4	7·84	..	..	..	..	4	1·310
Curb	..	..	2	2·02	1	0·645	3	0·983
Stringhalt	..	..	1	1·01	..	..	1	0·327
Unsoundness ..	9	17·64	9	9·09	7	4·515	25	8·19
Disapproval	9	17·64	12	12·12	9	5·806	30	9·834
Total ..	18	35·28	21	21·21	16	10·321	55	18·024

Side-line Crops in the Mildura District

By R. Roberts, Orchard Supervisor

THERE are various side-line horticultural crops which may be grown in the Mildura district and these can add to the interest as well as to the pocket of the block holder. This article deals with several crops which show possibilities of being grown with profit in this area.

This row of almond trees at Mildura acts as a windbreak for vines.

When consideration is given to the question of growing side-line crops in the Mildura district, we must look to crops which will give assured returns and for which provision of markets has been or is being made. It is interesting to note that plums grow well in Mildura, yet 50 to 100 tons of plum pulp are imported each year from southern districts by the local canning factory.

Tomatoes, both early and late, grow to perfection, yet the local trade could absorb twice as many as were received last season. It may be that the price paid for factory tomatoes was the limiting factor. Most of the tomatoes are made into sauce, although the cannery is also equipped for canning tomatoes.

There is room for expansion with regard to apricots and peaches, as the capacity of the local plant is about five years in advance of district plantings. At the present time this factory is working only six weeks in the year, three weeks on apricots and three weeks on peaches. With increased plantings of apricots and peaches a cool store would be necessary to cope with increased deliveries. These trees come into bearing in about three to four years and this is an important point to any one just starting.

Asparagus is another crop which could be considered. One grower claims to have taken £280 gross from 2½ acres. Apart from labour, his problem is high freight charges for this product. His harvesting, packing and transport costs amounted to 12s. 6d. per case. With the installation of pressure cookers, it will be possible to process asparagus at the local cannery.

Passion Fruit

There appear to be possibilities for passion fruit growing in the Mildura district. Although this is frost-sensitive, it is no more so than the lemon. Prices are satisfactory and locally-grown vines of ten years growth are still productive.

Almonds

In the early days of the settlement at Mildura, almonds were planted along boundaries, head ditches and irrigation channels to serve as windbreaks. Planting distances varied and no attention was paid to cross pollination. The *Brandés Jordan*

was favoured on account of its upright growth, but, although it blossomed freely, it set poor crops.

Later the doctrine of cross-pollination was preached to growers with very good results. Several blocks of almonds were set out, due regard having been paid to suitability of varieties for cross-pollination, and these have proved to be payable side-lines. As the trend is toward the sale and storage of almonds in the kernel rather than in the shell, growers favour varieties which can be easily cracked and which produce good kernels. *Hatch's Non Pariel*, *IXL*, *Ne plus ultra*, and *Johnson's Prolific* are some of the favoured varieties.

Returns per tree vary, depending on the care and attention bestowed on the trees. Under average conditions, a return of 12 to 15 lb. of nuts per tree could be expected. As with all trees, occasional outstanding yields are obtained and odd trees in the Mildura district have produced as much as 100 lb. of almonds.

Before the war, our requirements were some 800 tons of almonds of which some 400 tons were imported, and, from this, it would appear that there is room for expansion, particularly if a grower could supply his own family labour for gathering the nuts.

Olives

Approaching the question of olive growing as a side-line, one must do so with caution. Prior to the war, the development of the industry was restricted by competition with cheap oils from Mediterranean countries. From this area some 360,000 gallons of oil were imported each year. With reduced quantities imported into this country, production of olive oil has slowly increased in Victoria and South Australia.

Although it is not thought advisable to advocate the planting of olives on a broad-acre basis, there is room for expansion in growing olives as wind-breaks, street avenues, and along boundary fences where surplus irrigation water could be utilized.

Labour is the greatest limiting factor in olive growing, whether for oil extraction or for pickling. At Griffith (N.S.W.) last season, the cost of harvesting olives worked out at 5s. per half bushel case. One man would harvest about 3 bushels per day. The price of olives for oil at the factory is now £20 per ton, and there is not a great margin of profit after paying harvesting costs.

Figs

Figs have been grown successfully in the Mildura district, but of late years it is difficult to obtain labour to harvest the crops. On one or two blocks, figs, mainly Smyrna and Adriatic varieties, are grown for drying. Isolated trees and wind-breaks of other varieties are producing fruit which, if not allowed to rot on the trees, is devoured by birds. It is interesting to note that the local canning factory places figs fourth in the order of priority, preceded by citrus, apricots and peaches in that order.

Walnuts

A campaign instituted at Mildura a few years ago, and designed for the purpose of increasing nut production, induced two growers to turn their attention to walnuts. The varieties grown were Wilson's Wonder, Eureka, Concord and Franquette.

Wilson's Wonder is looked on more as a variety suitable for town gardens than as a commercial proposition. Eureka, Concord and Franquette are the only varieties suitable for the Mildura climate, being almost immune to bacterial blight. Most other walnut trees in the district are seedlings which are subject to bacterial blight. The hot winds, which are common in this district during the summer, play havoc with the foliage.

White Adriatic figs growing at Irymple.

Future Expansion

At the present time labour and water are the limiting factors in the growing of side-line crops. However, the soils and climate are suitable for many horticultural crops in addition to citrus and dried fruits. Should the price for dried fruits drop, growers with alternative crops will reap the benefit. With fast road, rail and air transport, there are possibilities in the growing of early varieties of peaches and apricots for the fresh fruit market.

CERTIFIED PULLORUM-TESTED FLOCKS (POULTRY)

A certified Pullorum-Tested Flock is one in which all stock over six months of age have given a negative reaction to the agglutination test for Pullorum Disease, and in which all such stock are kept under rigid conditions of isolation approved by the Chief Veterinary Inspector.

The undermentioned flocks have been certified by the Department of Agriculture, and will remain so for the current calendar year, or until such time as the Chief Veterinary Inspector determines.

Application forms are obtainable from the Chief Veterinary Inspector, Department of Agriculture, Melbourne. C.2.

Particulars of breeds of birds tested are as shown hereunder :—

A. Australorp ; B. White Leghorn ; C. Rhode Island Red ; D. Sussex ; E. Langshan ; F. Brown Leghorn; G. Buff Orphington ; H. Black Leghorn ; I. Minorca ; J. Ancona ; K. Legbar; L Indian Game.

Owner.	Breed.	Number of Birds.
Anguey, H., 138 Hargreaves-street, Castlemaine	A, B	725
Barastoc Experimental Farm (G. Lee Manager), Croydon ..	A. B, C	716
Bishop, Mrs. P. M., Springvale-road, Springvale	A, B, C	1,810
Burney and Pound, North-road, Langwarrin	A, B	1,731
Chalmers, H. L., 9 Lefevre-street, Spotswood	B, F, K	582
Collins, A. J., Emerald	A, C	354
Corbett Bros., Torbay-street, Macleod ..	A	2,318
Davies, L. F., Westall-road, Springvale ..	A, C	1,368
Davis, N. W., Mickleham, via Broadmeadows	A, B	3,089
Emmott, J. T., Verdon-street, Inglewood ..	A, B	293
Fletcher, J. H., " Homeleigh," Tallygaroopna	B	1,621
Ford, J. V., 11 Barkers-avenue, Shepparton	A, B, C	1,026
Gibbs, A. E., Stanhope	A, B	3,734
Guy, J., " Murlea " Murgheboluc.. ..	A, B, C	670
Harrington, G. W., Springvale-road, Tally Ho	B	1,836
Harrington, W. H., Woodward-street, Golden Square	A	1,597
Hopkins, C. A. and Sons, Success Poultry Farm, Knight-street, Shepparton	A, B	1,656
Inglis, W. J., Cobham-road, Mitcham ..	A, B	530
Kay, V., 12 Wellington-street, Blackburn	A, B	2,634
Kennedy, F., Ferntree Gully-road, Glen Waverley	A, B, C	677
Lattimore, A. G., Kilsyth	A, B, C	817
Lintermans, W. A. J., Major-road, Lysterfield	C	1,160
Magnusson, L., Nathalia	B	936
Maher, A. E., Wal Wal	A, B	765
Major, C. D., Simpsons-road, Eaglehawk ..	A, B	2,000
McCann and Sons, Crowlands-road, Stawell	B	4,198
McEwan, A. W. H., Whitehorse-road, Ringwood	A, B, K	157
McLauchlan, D. F., Rossiter-road, Koo-wee-rup	A, B	2,500
McTighe, C. H., Nar-Nar-Goon	A	571
Molsons White Leghorn Stud (G. Durkin, Man), 188 Surrey-road, Blackburn	B	1,311
Moran, S. G., Glenburnie-road, Mitcham ..	A, B	732
Moroney, J. B., Kangaroo Flat	B	1,150
McVay, A., Kernot-street, West Spotswood	A, B	2,506
Neal, J. H., 18 Watt-street, Spotswood ..	L	22
Niewand, F. J., " Kalang," Lubeck ..	A, B, C	1,275
O'Brien, R. J., Watson-road, Glen Waverley	A, C	694
Rae, J., Albert-street, Sebastopol ..	B, C	1,889
Ridge and Son, 43 Myrtle-grove, Blackburn	A, B, C	3,045
Robinson, W., 11 Olive-street, Hampton .	B, C	1,029
Rowe, Mrs. L. M., " The Wattles," Wal Wal	A, B	319
Salmond, J. B., Deer Park	H	246
Scales, J., West Wattle Tree-road, Boronia ..	A	1,492
Simpson, G. D., May-road, Glen Waverley	B	2,928
Smith, H. A., Marong-road, Malden Gully ..	A, B, C	1,196
Stewart, J., Maldon-road, Castlemaine ..	A, B	565
Swift, D. A., Kangaroo Flat	A, B	2,313
Taylor, R. H., 132 Rathgowan-road, Reservoir	A, B, C	3,730
Walton, F. R., Woodvale-road, Boronia ...	A, C	707
Welch, T. A., Bayswater-road, Croydon ..	A, B	3,062
Winter, G. A., " Denehurst " Murgheboluc ..	A, C	355

LIVE STOCK NOTES

Compiled by
A. C. T. Hewitt, M.Agr.Sc.,
Live Stock Science Officer

WHAT BREED OF PIG PRODUCES MOST WEANERS

AN analysis of "Pedigreed Sow Records" published by the New Zealand Department of Agriculture, shows the following figures for four different breeds of numbers weaned in each litter and the percentage lost prior to weaning.

Breed of Pig.	Percentage of Litter Lost Prior to Weaning.	Average Number of Pigs Weaned from Each Litter.
	%	
Large White ..	22·6	8·6
Berkshire	19·3	7·5
Tamworth	19·9	7·1
Large Black.. ..	25·9	7·0

The above analysis was prepared by A. Longwill, N.Z. Dept. of Agr.

Figures are not available for Victoria but in New Zealand the Large White breed is far more prolific than any of the other breeds and rears at least one pig per litter more than the Berkshire breed, which is more prolific than the Large Black and Tamworth breeds.

The average milking sow will eat about 7 lb. of balanced dry food daily to satisfy her own needs, and for each pig she is rearing she needs another ½ lb. of dry food daily. Over a period of eight weeks an average sow would eat about 400 lb. of dry food for her own maintenance. If she is rearing seven pigs, another 200 lb. will be required, making a total of 600 lb. If she is rearing nine pigs she will require 400 lb. for maintenance, plus 250 lb. for milk production for the litter, or a total of 650 lb. The extra cost for the 50 lb. of food for the larger litter of nine pigs is about 7s. 6d. If a creep is provided, each of the suckers should eat about 20 lb of dry food before weaning.

Seven sows producing nine pigs per litter will produce as many pigs as nine sows producing seven pigs per litter. The saving of food to produce the 63 weaners from seven sows is 850 lb. of dry food during the suckling period, plus the food consumed by the two extra sows for four months each half year when dry. The average dry sow will maintain her condition on 5 lb. of dry food daily and therefore will require about 600 lb. in four months.

The seven more prolific sows therefore can produce 63 weaners each six months with a saving of about 2,000 lb. of dry food. This amount of food saved each half year, is sufficient to produce another 400 lb. of pork which on present prices is worth about £25.

[A. D. North, B.Agr.Sc.,
Science Field Officer.]

MILKING THE DAIRY COW

When Dr. W. E. Petersen, Professor of Dairy Husbandry, University of Minnesota, U.S.A., visited Victoria last December, he stressed the need for thorough milking. In America the 25 million dairy cows take two billion man hours to milk each year. If the milkers did nothing else and worked 40 hours a week there would be a full time job for one million people. Milking is the largest single work job in the United States where no other job absorbs anywhere near one million people on full-time employment.

In America, only one-fifth of the work on the dairy farm is taken up with milking. Two-thirds of all the cows' feed has to be grown, harvested, stored, and fed to the cows. The cows have to be housed for nearly six months of the year, and much work is involved in attending them and keeping their stalls clean.

The work on the dairy farm is easier in this country because permanent pasture crops supply the bulk of the cows' feed and the cows do most of the harvesting themselves. There is little storage, carting out, or cleaning up.

The most important objective in milking is to obtain all the milk the cow secretes over a long lactation period, and this necessitates good milking. The best way to dry a cow off is simply to stop milking her; the next best way is to let a poor milker milk her.

Experience has shown that twice-a-day milking is best, and at each milking all of the milk in the udder should be removed. Any milk left in the secretory tissue of the udder makes back pressure which prevents the secretion of the usual amount of milk. Milking should be performed in such a way that all milk leaves the alveoli (the individual secretory units in the udder tissues), and passes to the milk cistern. The milker or the milking machine can only draw milk from the milk cistern. The milk can only be let out of each alveolus to drain into the cistern by pressure brought about by the let-down hormone, oxytocin, which is involuntarily released from the pituitary gland when the cow is relaxed and ready to be milked.

Dr. Petersen mentions five points necessary for efficient and thorough milking :—

(1) The cow must like being milked in order to relax and release the hormone, oxytocin, when about to be milked.

(2) The milking must be commenced and completed during the period that the let-down hormone operates.

(3) The cows must be trained to release the hormone and let down their milk, by regular and considerate shed routine.

(4) Hand-stripping should be discontinued, and all stripping done by machine.

(5) The machines should be removed from the cow immediately she is milked.

These matters will be discussed in detail in subsequent issues of the *Journal*.

THE TOP-PRODUCING COWS IN VICTORIA

Members of Young Farmers' Clubs frequently ask for yield figures of the cows which have produced the highest amount of butterfat in each breed.

The first cow to produce 700 lb. of butterfat in Victoria was the Red Poll, Muria, with 706 lb. in 1915. This record stood until 1920, when it was broken by the Jersey cow, Rarity VIII. of Melrose, with 719 lb. butterfat. In 1924, the Friesian cow, Dominion Queen Mercedes, produced 720 lb. butterfat, but the following year the Jersey cow, Babs of Somerville, produced 843 lb. of butterfat.

Babs of Somerville was the first cow in Victoria to produce over 800 lb. of butterfat and held the record for highest-producing Victorian cow until 1930, when the Friesian, Springfield No. 9, produced 860 lb. Springfield No. 9 held the record until 1942, when the Jersey, Banyule Tiddlewinks 26th, produced 935 lb. butterfat and was the first cow to produce over 900 lb. butterfat. This record stood for two years when the Guernsey cow, Yarraview Le Mode, produced 976 lb. of butterfat. In the following year, Yarraview Le Mode produced 963 lb. of butterfat, and has made the two highest butterfat yields for Victoria.

The production particulars of these cows are given in detail hereunder :—

Year.	Name of Cow.	Breed.	Milk.	Test.	Fat.
			lb.	%	lb.
1914–15	Muria	Red Poll	12,298	5·74	706
1919–20	Rarity VIII. of Melrose	Jersey ..	12,673	5·67	719
1923–24	Dominion Queen Mercedes	Friesian..	21,374	3·37	720
1924–25	Babs of Somerville..	Jersey ..	15,799	5·34	843
1929–30	Springfield No. 9 ..	Friesian..	21,209	4·05	860
1941–42	Banyule Tiddlewinks 26th	Jersey ..	15,096	6·20	935
1943–44	Yarraview Le Mode	Guernsey	15,000	6·50	976
(1944–45	Yarraview Le Mode	Guernsey	14,813	6·50	963

The highest records of cows in each of the breeds to the end of 1948 are as follows :—

Breed.	Name of Cow.	Milk.	Test.	Fat.
		lb.	%	lb.
Guernsey ..	Yarraview Le Mode ..	15,000	6·50	976
Jersey ..	Banyule Tiddlewinks 26th	15,096	6·20	935
Friesian ..	Springfield No. 9 ..	21,209	4·05	860
Ayrshire ..	Inverurie Thistledown	15,066	5·58	841
Red Poll ..	Victoria Electricity ..	16,103	4·82	777
Dairy Shorthorn	Willow Park Duchess 35th	19,242	4·11	791
A.I.S. ..	Douglas Vale Kassie ..	15,050	3·86	581

BROODING OF CHICKENS

Now is the time to prepare for the coming breeding season. Incubators and fittings, brooder-houses, brooders, drinking troughs, and food hoppers, should be thoroughly cleaned and disinfected to minimize the risk of infectious disease.

Ample accommodation should be provided in the brooder house and under the hovers. Overcrowding is risky, and the slightest check to the chicks during the brooding may result in heavy losses or permanent injury to the survivors.

Overcrowding provides ideal conditions for the introduction of coccidiosis and other diseases, and although the birds may recover they never do as well as those which have not had disease. It is well to remember brooders will soon become overcrowded if the maximum number of chicks is placed under them at one day old. It is better to place 80 day-old chicks under a 100-chick brooder and successfully rear the full number, than run the risk of losses due to overcrowding.

Chickens rear better on wire floors. These allow air to circulate under the chicks at night while they are confined to the brooder, and eliminate sweating. Wire floors also keep the chicks clear of droppings and eliminate damp spots which invariably develop under the hover when chicks are brooded on the floor, even though liberal quantities of rice hulls are used.

Thousands of chicks die each year during the brooding period, although diagnosis reveals no evidence of disease. Most of these deaths are due to the insufficient attention having been given to brooding which results in chilling and overheating.

Chickens need a clean, warm, healthy environment, particularly during the first weeks of brooding; and growth, food consumption and general activity should be vigilantly observed each day. Once the chickens look sick the complaint is firmly established, and although it is not possible to observe and anticipate all the complaints, many could be avoided by giving brooding first priority during the chicken season.

[M. D. Hall, Poultry Expert.]

PREPARATION FOR WINTERING BEES

Move the brood combs into the bottom box, and make a compact brood nest with pollen and honey-combs adjacent to the outside brood combs, and within easy reach of the cluster.

Many combs that appear to be solid honey will be found to contain a great deal of pollen. With the prolific pollen supplies from Manna Gum and the Stringybarks in the autumn, combs in the brood nest may contain up to 75 per cent. of pollen. This fact needs to be borne in mind when winter honey requirements are being assessed. It takes from 40 to 60 lb. of honey to winter a strong colony where a winter flow is not available.

Colonies with insufficient stores for winter should be given sealed stores from colonies with a surplus. Failing this, they should be given sugar syrup to carry them through winter.

Any colony found to be queenless should be united with a normal or queenright colony by the newspaper method. Remove the cover and place a sheet of newspaper over the cluster of the normal colony. Remove the bottom board from the hive of the queenless colony, and place this hive with its cover intact, above the newspaper over the normal colony cluster.

Both clusters should unite peacefully after gnawing away the newspaper, but if fighting should be observed, smoke the treated colonies liberally at intervals of ten minutes until it ceases.

All colonies should have a good waterproof covering, and the hive should be tilted slightly forward to drain any water from the bottom board.

Surplus combs should be stored away in dry places and made mouse-proof. Any wax moth should be destroyed by fumigating with carbon bisulphide.

Honey residue allowed to remain on equipment leads to rusting, and a good general practice is to scour the equipment, dry thoroughly, and give it a liberal coating of silver lacquer.

[W. A. Collins, Senior Apiary Inspector.]

TUBERCLE-FREE HERDS

ACCREDITED TUBERCLE-FREE HERDS

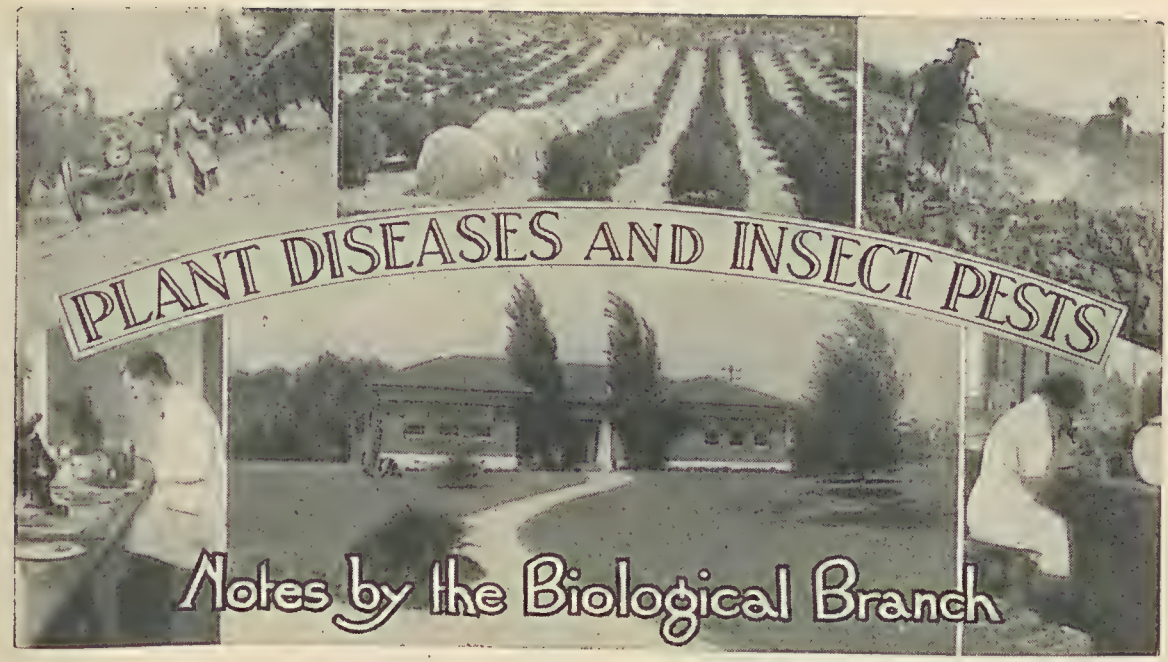
The following herds have been declared free of tuberculosis under the *Accredited Tubercle-free Herd Scheme* conducted by the Department of Agriculture. Under this scheme a tubercle-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests or upon disclosure of infection, three semi-annual, successive, physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

Name.	Address.	Number in Herd.
Aboriginal Station	Lake Tyers	86
Ampt, E. W.	Gymbowen	8
Ampt, N. C.	Gymbowen	20
Ballarat Orphanage	Ballarat	139
Banyule Stud Pty. Ltd...	Wangaratta	55
Beggs, A. R.	Beaufort	116
Black, I. S., Estate of	Mount Noorat	64
Bleakley Bros.	Horsham	14
Bott, J.	Yarrawonga	70
Bruhn, C. H. and V. I.	Mirboo North	54
Candler, G. E.	Hamilton	35
Carne, W. J.	Pakenham Upper	30
Cason J. M.	Lima South	63
Clark, P. W., and Son	Whittlesea	95
Clark, W. J	Monomeith	142
Cowan, G. L. S.	Bacchus Marsh	61
Cox, F. G.	"Birradale," S. Lyndhurst	47
Cribbes, T.	Wangaratta	40
Deering, J. T.	South Wangaratta	79
De La Rue, N. C.	Tomahawk Creek	69
Dookie Agricultural College (Ayrshire Herd)	Dookie	117
Dookie Agricultural College (Hereford Herd)	Dookie	38
Drechsler, W. P.	"Berry Bank" Swan Hill	102
Eagle, W. H.	Womerah	31
Everist, F. R.	Tyabb	12
Fixter, A.	Boisdale	26
Foletta, G. G., and Son	Buxton	121
Fraser, S. T.	Tomahawk Creek	52
Geelong Grammar School	Corio	81
Gilbert, J. A. and R. D.	"Brockelbank," Yinnar South	108
Gilmour, D. W. and N. B.	"Yarravale," St. Hubert's-lane, Yering	121
Gleeson, P. J., and Son	Tynong	261
Goddard, James H. & Sons	Cora Lynn	104
Gorman, A. W.	"Cathcart," Alexandra	57
Griffiths, J. G.	Benalla	121
Bross, Mrs. G. F.	Horsham	33
Hamilton, A.	Flinders	69
Haywood, A. R.	Mordialloc	184
Hicks, E. J. & Sons	Echuca	100
Howell, G. G.	Wollert	130
Howlett, Mrs. G., and Miss E. Samuel	Lang Lang	84
Ivone, M., and Sons	Ovens	103
Jackson, H.	Lockington	81
Johnson, F. G.	Horsham	34
Jones, A. C.	Barnawatha	182
Keele, H. A.	Bamawm	79
Kelynack, P. T.	Bundoora	92
Kemelfield, J.	"Wongala" Woodend	46
Kemp, E. J.	Horsham	15
Kinglsey-Newell, F. J.	Shoreham	60
La Fontaine, G.	Mitta Mitta	61
Lawrence, P. H.	"Rainga," Tarrawarra	89
Lawton, W.	Frankston	56
Light, D. T.	Noradjuha	8
Longerenong Agricultural College	Dooen	49
Luke, K. G.	Romsey	32
Maloney, P. J.	Tongala	66
Maybery, A. H.	Mitre	18
Middleton, J. A.	Labertouche	80
Moore, J., and Co.	Yarram	109
Murray, M. G.	Lima	19
McIntosh, J.	Merrigum	77
McKenzie, A. E.	Kerang	54
McKenzie, Mrs. E. J.	Woodford	81
McKenzie, H. P.	Trawalla	23
McNabb, G. A., and Son	Irrewillipe East	191
McPherson, A. L. and J. J.	Kyneton	95
Nancarrow Bros.	Kerang	56
Newton, J. M., and Sons	Whorouly	63
Nicholas, M. A.	Sherbrooke	79
Noonan, Mrs. S. A.	Benalla	68
Northcote Children's Farm	Bacchus Marsh	83
Payne, A. E. T.	"Yarra View," Lilydale	78
Payne, T. E. N.	"Woodburn," Kilmore	72
Poole, M. A. and D.	Caldermeade	143
Poole, M. A. and D.	Yannathan	103
Potter, W. J.	Longwarry North	118
Prosser, J. E.	Ondit	40
Read, exors., Estate I. D.	Springhurst	99
Rix, A. A.	Officer	79
Roe, Thomas H. P.	Cobram	15
Sanderson, R. F.	"Pleasant Hill," Kyneton	75
School of Horticulture	Burnley	7
Scott, A. L.	"Wolonga," Kongwak	43
Selwyn-Scott, F. E.	Scotsburn	66
State Experiment Farm	Rutherglen	49
State Research Farm	Werribee	203
Stephens, Dr. F.	Vermont	34
St. Joseph's Home	Sebastopol	59
Thomas and Taylor Pty. Ltd.	Hamilton	26
Till, J. A.	Tongala	58
Tucker, E. G.	Horsham	72
Vagg, T. R.	Officedale	56
Vagg, F. G.	Leongatha	57
Variety Investments Pty. Ltd.	Woori Yallock	127
Warnock, J. A.	Lima South	77
Waterhouse, H. W. and Son	Pakenham	70
Williams Victoree Farms	Dalmore	203
Williamson Bros.	Carlsbrook	119
Wilson, J. L.	Koo-wee-rup North	90

In addition to the above the following is a list of herds in their respective districts which have given negative reactions to two or more successive tests conducted by departmental veterinary officers, but, inasmuch as replacement cows are only submitted to one test before being admitted to the herds, they cannot be considered as accredited under the Accreditation Scheme which requires, among other things, that no cow shall be admitted to the herds unless it has given two (2) negative reactions at an interval of 60 days, and must be kept in isolation during the period between the two tests.

District.	Herds.	Cattle.
Ararat	11	291
Bairnsdale	4	109
Ballarat	122	3,050
Benalla	43	298
Bendigo	96	3,682
Broadmeadows	48	2,200
Colac	11	345
Doncaster	14	631
Geelong	101	3,692
Hamilton	2	94
Heidelberg	20	627
Horsham	13	650
Morwell	3	270
Orbost	1	99
Portland	7	431
Rutherglen	20	296
Sale	5	341
Terang	1	10
Traralgon	4	218
Wangaratta	38	475
Warrnambool	7	428
Whittlesea	105	4,664
Yallourn	4	269
Yarragon	36	1,630
Yea	26	73

There are also 398 herds in which 15,796 head of cattle have passed one test and may be considered, therefore, to be in process of becoming tubercle-free herds.



VINE MILDEW

In Victoria, the grape vine is attacked by two diseases commonly known as "mildews". Of these, Powdery Mildew is by far the most prevalent and economically important. It is caused by the fungus, known in its "perfect" stage as *Uncinula necator*, but commonly met with as the "imperfect" spore form *Oidium Tuckeri*. The other is Downy Mildew caused by the fungus *Plasmopara viticola*.

Both of these diseases are encouraged by warm, moist conditions and in a wet season are likely to be very prevalent unless special precautions are taken.

Powdery Mildew

Powdery mildew causes dusty-looking patches to appear on the upper and lower surfaces of the leaves, on the young canes and on the berries. The disease usually results in a poor setting, scraggy branches, and a cracking of the berries just before ripening. Infected berries may fail to develop the sweetness and flavour characteristic of the uninjured fruit. The fungus grows mainly externally pushing root-like structures (haustoria) down through the skin to absorb nourishment. When this superficial fungal growth is rubbed away the berries and canes exhibit a typical russet-like appearance.

Powdery mildew, being a superficial fungal growth, is favoured by shady conditions and the presence of abundant moisture on the foliage of the plant. For this reason the grapes should be grown in such a position that they will receive full sunlight for most of the day. Watering, especially overhead watering, should be reduced to a minimum. Should excessive leafy growth develop during summer it may be necessary, by judicious pruning, to thin out the foliage and allow plenty of air and sunlight to penetrate the interior of the vine.

In addition to the above precautions it will be necessary to dust the vines periodically with flowers of sulphur. The first dusting should be given when the buds burst in the spring, a second just prior to blossoming, and a third at blossom time (this is important to assist a good setting of fruit), followed by subsequent dustings as required by seasonal conditions. In a hot, dry season the first three dustings should be sufficient, but if warm, "muggy" conditions develop further dustings should be given.

The sulphur can be applied by shaking it through a piece of hessian or some other coarse material, or by the use of a special hand-duster. The sulphur should be applied thinly and uniformly over the whole vine—a heavy deposit of sulphur should be avoided as it may cause burning on hot days.

Grapes infected with powdery mildew.

Downy Mildew

Downy mildew first appears on the upper surface of the leaf as a discoloured, irregular patch of slightly paler hue than the rest of the leaf, and with the advent of moist conditions the under surface of the patch becomes covered with a dense downy substance. This is rarely seen on the upper surface of the leaf or on the shoots or flowers. With a serious infection many of the leaves may fall, and a poor crop will result. Occasionally the fruit is attacked. If this occurs early in the season the flesh presents a greyish-white appearance and later dries up; if attacked later, the berries become discoloured, finally assume a dull red colour, and fail to ripen.

This disease, like powdery mildew, is favoured by warm, moist conditions, and the cultural measures recommended apply also to downy mildew. In addition, the vines should be sprayed with Bordeaux mixture 10 : 5 : 50 in early October, when the young shoots are 6 to 10 inches long; again just after flowering (three to four weeks after the first application), and in January. No further applications should be required unless conditions become favourable for the development of the disease.

To prepare a small quantity, say 5 gallons, of 10 : 5 : 50 Bordeaux mixture, dissolve 1 lb. of copper sulphate (bluestone) in $2\frac{1}{2}$ gallons of water in a non-metallic vessel (wooden, glass, or earthenware). Mix $\frac{1}{2}$ lb. of fresh "quick" lime or 12 oz. fresh hydrated lime in another $2\frac{1}{2}$ gallons of water. Pour the two materials simultaneously into a third vessel. To prepare a large quantity (e.g., 80 gallons) dissolve 16 lb. of copper sulphate in 72 gallons of water in a spray vat. Then mix 8 lb. of fresh "quick" lime or 12 lb. fresh hydrated lime with 8 gallons of water, start the agitators, and slowly pour the lime solution into the vat.

SPOTTED WILT OF ORNAMENTAL PLANTS

The spotted wilt virus which causes the disease in tomatoes, also infects a number of ornamental species grown in home gardens.

Grape vine leaf infected with downy mildew.

The virus is carried from infected to healthy plants by two species of thrips which are most prevalent during moderately cool weather. In southern Victoria the most favourable conditions for the multiplication of thrips occur during spring, early summer, and autumn. In northern Victoria the autumn infestation of thrips usually continues further into the winter than it does in southern districts.

The most commonly grown ornamental species susceptible to infection with spotted wilt virus are chrysanthemum, dahlia, Iceland poppy and zinnia.

Iceland poppy infected with spotted wilt.

Dahlia

The severity of disease symptoms on the dahlia varies according to the variety. Some develop severe ring-spot markings or oakleaf patterns on their lower leaves, whereas others show considerable tolerance to the disease and symptoms are difficult to detect.

Symptoms are most intense early in the growing season, when the growth of infected plants is stunted compared with that of healthy plants. A recent report from U.S.A. states that spotted wilt infection was eliminated from stocks of one highly-susceptible variety by taking tip cuttings from shoots newly emerged from diseased tubers. These shoots appeared healthy, but developed symptoms if left attached to the roots. The cuttings were readily rooted and the majority of them remained healthy throughout the growing season.

Growers who normally propagate dahlias from tuber cuttings would be well advised to test the effectiveness of this method of disease control.

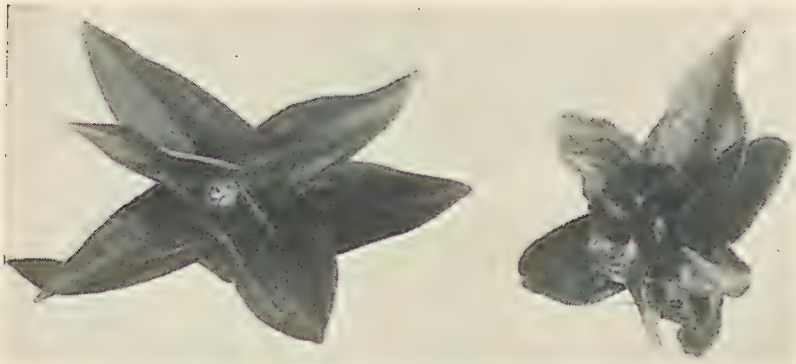
Chrysanthemum leaf infected with spotted wilt virus.

Chrysanthemum

Symptoms on chrysanthemum are somewhat similar to those on dahlia as the lower leaves of infected plants show ring-like markings and growth stunting occurs. Chrysanthemums and dahlias are important host plants as they perpetuate the disease from year to year and may be the means of spreading it to new areas.

Iceland Poppy

This plant is also an important host, as it provides a reservoir of infection for



A healthy zinnia, and one infected with spotted wilt.

spring-planted annuals and vegetables such as tomatoes, in home gardens. The virus causes yellowing, mottling, and malformation of the foliage and infected plants may wilt and die prematurely. The flower stems become twisted and bent and exude drops of white latex which harden and turn brown on exposure to air.

Zinnia

The zinnia is now difficult to grow successfully because of its susceptibility to the spotted wilt virus. The disease causes mottling and distortion of the foliage. Infected plants are stunted and yellow rings or blotches frequently develop on the younger leaves.

The only method of controlling spotted wilt in ornamental species at the present time is by the indirect approach of combating thrips which spread infection. DDT is very effective against this insect, but must be applied at weekly intervals to maintain continuous protection against virus carrying thrips flying in from untreated areas. The best results are likely to be obtained by applying DDT in spray form, but complete freedom from infection cannot be expected.

With ornamental plants like zinnias the effect of the disease will be less obvious if the plants are massed in separate beds, instead of being planted singly with other species in mixed beds.

MOSAIC OR INFECTIOUS VARIEGATION OF THE APPLE

A leaf variegation or mosaic, which is attributed to a virus disease, is common in Victorian apple orchards.

The variegation forms an irregular pattern of cream or yellow areas which may replace portion of the normal green colour of the leaf. Chlorosis may be restricted to one side of the leaf, to the main veins, or occasional spots, or most of the leaf surface may be affected.

Severely affected leaves are frequently distorted. During the summer months, the chlorotic areas turn brown and die, and leaf fall is accelerated.

The disease is most prevalent and variegation is most pronounced on the Jonathan variety.

The symptoms of the Victorian disease closely resemble those described for mosaic diseases of supposedly virus origin, which affect apples in Great Britain, South Africa, and the United States of America.

Experiments conducted in Victoria have shown that scions from an infected tree, when grafted on to a healthy tree, will produce variegation in the hitherto healthy foliage. This evidence, in the absence of any fungal or bacterial pathogen, suggests that the disease is caused by a virus.

Apple twig infected with mosaic disease.

There is no evidence that the virus is carried to healthy trees by pruning, and the slow spread of infection in apple orchards indicates the absence of an insect carrier. It is most likely, therefore, that the disease spreads entirely as a result of budding and grafting operations.

The disease has little effect on growth or yield, although severely affected trees have been observed. It seems logical to assume, however, that the continued interference with the normal functions of a tree resulting from the destruction of the normal green colour of the leaves and premature defoliation must, in time, have some adverse effect on growth and yield.

Orchardists and nurserymen would be well advised, therefore, to remember that they are dealing with a virus disease and to avoid selecting grafting and budding material from any part, including the roots, of mosaic-infected trees.

ORCHARD AND GARDEN MITES

There are a number of mites which attack orchard and garden plants in Victoria, and these will be dealt with in a series of notes describing the principal species, the damage they cause and the methods of control.

BRYOBIA MITE (*Bryobia praetiosa*)

Bryobia mites commonly attack apple and pear trees in Victoria. Peaches almonds and other trees including ornamentals may also be attacked.

The mites are found on the undersides of the leaves during the spring, summer and autumn. Affected foliage fades to a characteristic yellowish-green or bronze, and trees which are badly attacked have a distinctly unhealthy appearance.

The eggs are attached to the bark of the limbs of the affected trees, and the old white shells may adhere firmly for more than one season. Where infestation is heavy, the eggs which are minute, red, and globular, may be so numerous that they completely cover portions of the limbs. The encrusting masses of old white shells and fresh red eggs may give the branches a pinkish colouration.

Life History

The adult mite is about one twenty-fifth of an inch in length, with a velvety brown body and eight legs, the first pair being much longer than the others. These extend directly in front of the mite and are constantly vibrated when the mite is in motion. The mites hatch from the overwintering eggs in the spring, leaving behind the white shells of the eggs attached to the bark. At this stage, the mite is bright red in colour with a rounded body and six legs.

As the mite grows the body colour darkens and another pair of legs are formed. The mites feed on the undersides of the leaves rasping the surface and sucking the sap. There may be several generations in a season. The overwintering eggs are laid in the autumn.

Control

Bryobia may be controlled by winter spraying with red oil 1 in 16 to destroy the eggs. Thorough spraying is essential, in order to obtain complete cover. While lower concentrations than 1 in 16 will probably give good results, the advantage of obtaining freedom from bryobia by one winter spray makes the stronger preparation advisable. There is some evidence that spraying during late dormancy gives better results than earlier treatment.

If bryobia occurs during the summer, it may be controlled by spraying with hexaethyltetraphosphate (HETP) 1 in 1600. Two sprays should be given with an interval of ten to fourteen days between to kill mites which hatch out after the application of the first spray.

If winter spraying is carried out thoroughly, summer spraying should not be necessary.

RED SPIDER (*Tetranychus urticae*)

Red spider attacks a wide range of ornamental and crop plants including trees, shrubs and smaller plants. Weeds are also attacked. The mites are found on the undersides of the leaves, which, like leaves affected by bryobia, fade to a yellowish-green.

In contrast to bryobia, red spider spins on the underside of the leaf a very fine web under which it shelters. Plants severely affected by red spider have an unhealthy appearance. Plants are most susceptible to injury from red spider where the moisture supply is inadequate.

Red spider is not aptly named. Newly-hatched mites are practically colourless and the majority of adults are greenish-yellow with a dark patch on each side of the back. In the autumn, brick-red female adults appear. The adult mites are about one twenty-fifth of an inch in length. At birth they have six legs, but later develop two more. The front legs are not as long as those of bryobia. The eggs, which are spherical and almost colourless are laid on the undersides of the leaves of affected plants. Between early summer and winter several generations of mites occur.

The adults, including a proportion of red coloured forms, hibernate during the late winter in sheltered positions, emerging in late spring to feed and lay eggs.

Control

Cultural practice is important in controlling red spider. Weed growth must be suppressed, and an adequate moisture supply must be maintained. It is often necessary, however, to supplement these practices with insecticidal treatment.

Dormant trees, fences, props, and stakes must be sprayed thoroughly with lime sulphur 1 in 10 or red oil 1 in 16.

Trees in full leaf attacked by red spider may be sprayed with hexaethyltetraphosphate (HETP) 1 in 1600 or lime sulphur 1 in 80 during mild weather, or 1 in 100 during periods of high temperature.

In areas known to be infested with red spider, summer annuals and vegetables should be sprayed or dusted before the foliage develops to a degree where it is difficult to obtain complete cover. Dusting should be carried out with a mixture of two parts by weight of finely-ground sulphur to one part by weight of hydrated lime.

For spraying HETP, 1 fluid ounce in 10 gallons of water is effective. Alternatively, lime sulphur may be used.

The strength of the lime sulphur must be varied according to the temperature at the time of spraying. In early spring, when temperatures are low, 1 in 35 may be used. Later in the season, when temperatures are higher, 1 in 70 may be used during mild weather, decreasing to 1 in 100 during mid-summer.

Virus Degeneration of the Strawberry

Virus degeneration diseases of the strawberry are an important problem to the local industry. The most serious virus disease of strawberries in Victoria is known as crinkle, so-called because of the characteristic malformation symptom produced on the leaves of infected plants. There are at least two forms of this disease in commercial areas. One, commonly known as mild crinkle, has spread throughout all varieties. The other, known as severe crinkle, is caused by a different virus. When a plant infected with mild crinkle virus becomes infected with severe crinkle virus, a very severe form of the disease results. This is known as severe crinkle.

Both viruses are spread by a small white aphis which feeds on under surfaces of the leaves and on the young crown leaves. The strawberry aphis is the only insect known to be capable of transmitting infection with these diseases and it is believed that it breeds only on the strawberry plant.

Investigations in progress at the Plant Research Laboratories, Burnley, are concerned with the propagation of virus-free stock of several varieties, the testing and possibly the production of virus-resistant varieties, and methods of control of the strawberry aphis.

The problem of strawberry degeneration is world-wide and has not yet been solved, even in England, where investigations have been in progress for the past seventeen years. However, considerable progress has been made and the possibility of disease control looks somewhat brighter now than in the past. Growers should realize, however, that spectacular results are unlikely to be obtained in the near future.

[Contributed by the Biological Branch.]

THE FLOWER GARDEN

By George Hyam,
Horticultural
Supervisor

Lilium regale. This attractive lily blooms in December.

LILIUMS NEED ATTENTION IN MAY

LILIUMS are a bulbous form of perennial and their stems should be cut down in May, not quite to ground level but just sufficient to allow a portion of the old stem to be bent over. This is to avoid moisture entering the hollow of the old stem which can cause a dormant lilium bulb to rot when left in the ground.

Many growers prefer to lift liliums every year. They should be lifted every third year in any case so as to remove off-set bulbs and to avoid overcrowding. May is the best month to carry out this work, and to make new plantings.

Lilium bulbs are never completely dormant, and are best re-planted as soon as possible, before their rootlets wither. Lilium rot can be checked if lifted bulbs are dipped before planting in one of the organic mercury dips recommended for gladiolii corms in the March *Journal*. Immersion, however, should be for about half the period listed for gladiolii corms. Lilium rot is encouraged by bad drainage so, when re-planting, see that the drainage is good. One way in which this can be helped is to sit the bulbs on an inch layer of sand and then surround the whole bulb with another layer before filling in.

Planting Depth Important

Planting depth is important. Some liliums root at the base only and are planted from 4 to 6 inches deep according to size of bulb or at a depth equivalent to twice the height of the bulb. Others are stem rooting as well as forming roots at the base. These should be planted 8 to 10 inches deep. Stem rooting species include *L. Henryii*, *L. longiflorum*, *L. regale*, *L. tigrinium*, *L. suphurium*, and *L. auratum*. Base rooting kinds requiring shallower planting include *L. Canadense*, *L. Martagon*, *L. pardalinum*, and *L. superbum*. The well known *L. candidum* or Madonna Lily does best when planted even more shallowly, with its top about 2 inches under ground.

In all but the hill districts in this State, liliums do best when planted where there is some top shade protecting them from the summer midday sun. Use blood and bone as the fertilizer under the bulbs, but not actually touching them, again deferring the use of the quicker-acting manures until the flower stems form.

In addition to the naturally formed offsets, most lilies can be propagated by inserting individual scales from a bulb in boxes of sand just below the surface and spaced about 1½ inches apart. The boxes should be kept in a frame or on a warm window-sill during the winter, and under shade in spring and summer and, of course, the sand must be kept moist at all times but not waterlogged. They are planted out in an open bed next year to grow on to flowering size the following year.

LIFTING HERBACEOUS PERENNIALS

The old flower stems and foliage of all herbaceous perennials should now be cut down to ground level with the exception of the few which flower during the winter. Those which have not been lifted for the past three years will almost certainly need dividing. Any perennial flower growing from a central crown or from self-rooting runners gradually exhausts the middle of the clump and all new growth is on the outside. As time goes on, the vigor of this outside growth is lessened also, as the soil around and under the plants becomes exhausted. May or early June is the best time to divide and re-plant, as with most perennial flowers there is some root growth during the dormant winter period. Early re-planting or establishing new plants, therefore, can improve the first season's flowering.

The new plants should be divisions taken from the outside perimeter of the old clump the centre of which, in most cases, is best thrown away. When planting or re-planting, enrich the soil under perennials, either by digging in rotted stable manure or applying a good handful of blood and bone to each plant site. These are better base manures than the quicker acting fertilizers which, if used at all, are better applied as a top dressing to a herbaceous bed during the spring and before flowering.

ESTABLISHING A VIOLET BED

This delightful spring flower will grow in practically every part of the State, though in the warmer areas violets have to be frequently watered in summer to prevent the plants becoming scorched. In such places a summer mulch of straw spread over the plants is often desirable. A common mistake is to plant violets in shade; they need to be completely in the open when they flower in early spring, although it is sometimes an advantage to plant them where a deciduous tree will give midday shade in summer.

Although a true perennial, the plants should be lifted every second year otherwise their flowering will be meagre, and like other perennials, it is best to discard the centre of the old plant and re-plant well-rooted runners which form in the same manner as in strawberries.

Violets make excellent edgings. They do particularly well in a rich soil, and can well be planted as an edging to vegetable beds as they contribute little to a garden flower display, being mainly a flower for picking. Lime the ground for violets early this month, then dig in stable manure or compost and plant out at the end of the month or early in June, spacing the plants 12 inches apart. Mulch around the plants in spring and at all times keep the soil moist.

Not many varieties are now available but Princess of Wales and Princess Mary, which are among the best, can usually be bought. Parma violets and any double varieties need some shade in most districts to flourish well. During growth, it is best not to allow runners to root, except when required for re-planting or to increase the stock, as they tend to exhaust the plants.

The only likely difficulty in raising violets is attack by red spider in summer and autumn. The method of control is similar to that used for this pest on vegetables, namely spraying with nicotine, HETP, or lime sulphur, or dusting with a gammexane preparation, taking care that the undersides of the leaves are covered. As a precaution against a carry-over on purchased plants, it is a good plan to dip them in a solution of nicotine and white oil before planting.

Like many other flowers, regular picking before the flowers fade and set seed will increase the number of blooms produced during the flowering season, and after the second year, the crop will quickly decline when a new planting should be made.

THE VEGETABLE GARDEN

By George Hyam, Horticultural Supervisor

WINTER TREATMENT OF ASPARAGUS BEDS

ALTHOUGH asparagus rust is seldom seen in Victorian gardens, it has made its appearance this season, probably due to the high humidity, cool spring, and early summer. The presence of asparagus rust is first denoted by a rusty-brown appearance on the tips of the foliage, similar to, but of a deeper colour than the burning sometimes caused by hot winds. Later, it appears as black streaks on the stems. If all the foliage and stems on an affected plant are cut off at ground level as soon as these symptoms are noticed, irrespective of the time of the year, and the adjacent plants are sprayed with Bordeaux 6 : 4 : 40, it is fairly easy to prevent the disease spreading. The affected stems should be burnt, for if left to ripen and the needles fall to the ground, the autumn spores can affect the next season's sticks which come up distorted and have discoloured tips.

The modern practice is to cut off the foliage as soon as it commences to turn yellow, instead of waiting until it is completely dry. This yellowing generally occurs in early May or after the first frost. Cutting at this stage ensures that the berries will not be sufficiently ripe to fall, and saves trouble with self-sown seedlings which, if allowed to grow on, can overcrowd and exhaust a bed before its time. On the other hand, if the normal foliage is cut too early while still very sappy, the crowns may be weakened to some extent. Unaffected stems should be cut off 3 or 4 inches above ground so that the position of the crown is indicated when the beds receive their winter cultivation.

May or June are the best months to apply the annual dressing of organic manure which all asparagus beds should receive. Stable manure or compost spread in layers about 4 inches or 2 inches deep respectively and lightly forked or disced under the surface, is the ideal quantity. Poultry manure, plus superphosphate at the rate of about 2 lb. to the bag of manure, is also a good dressing, using one bag to 10 square yards. Asparagus also responds very well to sea-weed and generally rather better than to the other organic manures. In acid soils, a dressing of lime could be given with advantage a week or two before applying the manure. After working in the manure, leave the surface in the rough until August when fertilizer is added and the beds are made up for the forthcoming season.

MANURING RHUBARB

Another vegetable garden perennial—rhubarb, should also receive attention this month, because like asparagus, next season's stem buds are in the process of formation in the apparently dormant season. Thus early manuring will have a beneficial effect.

First, trim off all wilted and yellowing leaves and fork in the remains of last season's mulch, taking care not to damage the crowns or buds. Next, fork in about half the quantity of organic manure recommended for asparagus and give each plant about 1 oz. of blood-and-bone. Finally, spread a good thick mulch of straw or strawy stable manure over the crowns. This has the effect of producing early stems. If the crowns have been yielding for four or five years or more, they should be lifted and replanted. For this purpose use pieces taken from the outside of the old crown which have two nice plump buds.

Whether in the home garden or in commercial plantations, it is wise to have some new plants coming along every year and not retain crowns that have passed their best or which are affected with crown rot. This disease is usually indicated by dull foliage and small sticks produced only from side buds. When lifted, the centre of diseased crowns show a brownish rot and such plants should be burnt.

GARLIC AND SHALLOTS

Although garlic and shallot bulbs can be planted from May to July, early planting will produce the highest yields and the largest bulbs. Shallots should be planted in very firm ground and, if necessary, the beds should first be trampled or rolled.

The sets are pushed into the soil, leaving about one-half of the bulb above ground. Planted in this way they will grow large, almost round bulbs. If planted deeper, these will be long and thin. Spacing should be not less than 9 inches apart in the rows and 12 inches between rows.

Garlic is better planted in a furrow or trench 3 inches deep. The sets or " cloves " are pressed into the bottom of the trench every 6 inches along its length, and the furrows should be spaced not less than 12 inches apart.

It is a good practice not to fill in the trench until each set has sprouted a shoot about 1 inch long. This usually occurs a month or so after planting. Larger bulbs are obtained in this way. Garlic does best in light soils. However, both garlic and shallots will grow in any well-drained, fairly friable soil and they need no special manuring unless the soil is very poor, when some blood and bone could be applied with advantage.

In districts where onions are known to do well, consideration might be given to growing small commercial areas of these two bulbs, as the demand for them is increasing. It is somewhat difficult to sell large lots on the ordinary vegetable market, but processors and pickle manufacturers are contracting for fairly large supplies at what seem to be payable prices. There has also been some enquiry for garlic for export to the East.

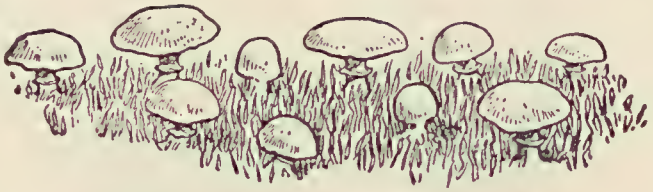
Processors are particular with regard to type and quality of bulbs required. New growers, therefore, are advised to grow a small area and obtain samples to show processors what they can produce when seeking a contract. Any balance could be marketed through the usual produce agents even if it amounts to only a bag or two. The home gardener will find that shallots are a good substitute for onions for all purposes and their foliage is useful for salads.

OTHER MAY WORK

Broad beans can still be sown in all districts, but in the south little advantage is gained by sowing in May rather than July. Early crops of peas—the Wm. Massey (Melbourne Market) variety—can be sown in May in all northern districts, but they should not be sown when the soil is very wet. It is preferable to sow seeds in almost dry soil, relying on the first rain to germinate them. Heavy rain after sowing in wet soil generally causes the seed to rot. Dusting the seed with the special legume dust, Tetroc, before sowing, lessens the risk of rotting in any normal weather.

Leeks should now be earthed up as much as possible to increase the length of the white stem. May is the sowing time for Brown Globe onions and sowings of Odourless onions can still be made. The first sowing of Australian brown onions can be made at the end of this month in the warmer areas.

Tomato plants in home gardens that are still bearing green fruit could be pulled up and hung with the fruit left on them in a shed or under a verandah, out of frost. The fruits will gradually colour and most will be quite usable in salads. Larger quantities of tomatoes can be ripened between layers of straw in fruit cases. Commercial growers now use specially constructed and moderately heated glass houses for this late ripening.



LICENSED SKIN BUYERS

Sheep Owners' Protection Act

List of persons licensed under the Sheep Owners' Protection Act to buy raw sheepskins. The licences are effective to the 31st December, 1949.

Licence No.	Holder of Licence.	Business Address.
2876	Ainslie, J. D. ..	Forrest-street, Castlemaine
2763	Alexander, H. H. ..	Kirkland-avenue, Euroa
2753	Allan, J. R. ..	19 King-street, Melbourne
2760	Allwood, W. H. ..	High-street, Rutherglen
2744	Angliss, W., and Co. (Aust.) Pty. Ltd.	Imperial Freezing Works, Lynch-street, Footscray
2831	Austin and Ford Pty. Ltd.	Austin-street, Hopetoun
2823	Baker, C. J. ..	Woods-street, Donald
2730	Banks, C. L. ..	42 Barkly-street, Ararat
2806	Barrett, H. L. ..	Sale
2854	Bassler, J. F. ..	Canterbury-road, Vermont
2875	Bennett, S. C. ..	71 Isabella-street, Geelong West
2860	Berman, D. ..	294 Little Collins-street, Melbourne
2883	Biggs, H A., and Son	Commercial-street, Korumburra
2827	Birchall, Thomas ..	180 Harold-street, Thornbury
2894	Black, S. B. P. ..	2 Bradshaw-street, Ballarat
2868	Borthwick, T., and Sons	84 William-street, Melbourne
2791	Bourke, D. ..	89 Cox-street, Hamilton
2761	Brooks, Mrs. E. J. ..	Guthrie-street, Quambatook
2785	Bryant, A. J. W. ..	Hanson-street, Corryong
2816	Bunn, W. G. ..	South-road, Warragul
2774	Burns and McCleave	206 Mair-street and Gong Gong-road, Ballarat
2872	Burrows, G. A. ..	27 Scoresby-street, Kerang
2747	Butler, E., and Sons	Tallangatta
2772	Byerley, H. M. ..	115 Wright-street, Adelaide, South Australia
2901	Calder Trading Co. Pty. Ltd.	Commercial-street, Korumburra
2749	Callan, P. J., and Sons	6–8 Moorabool-street, Geelong
2800	Canfield, E. F. ..	Gillies-street, Rochester
2745	Carlile Bros. ..	Strickland-road, Bendigo
2821	Cary, W. A. ..	High-street, Heathcote
2755	Claffey, A. S. ..	King-street, Rainbow
2845	Cohuna Sales and Service (Geo. Stone)	Main-street, Cohuna
2756	Cole, M.	Camperdown-road, Terang
2810	Cook, I. J. ..	Allansford
2764	Cook, T. J. ..	Black-street, Terang
2820	Cooper, A. S., Pty. Ltd.	87 Lambeth-street, Kensington, W.1
2819	Coulstock, K. ..	65 Welsford-street, Shepparton
2851	Dallimore, P. J. ..	Dandenong and Noble Park
2770	Dalrymple, A. J. ..	Allan-street, Kyabram
2788	Dewez, T., and Co. Pty. Ltd.	120 King-street, Melbourne
2887	Diviny, B. ..	King George-street, Cohuna
2818	Downes, A. J. ..	Ritchie-street, Dunkeld
2877	Duggan, T. A. ..	Mollison-street, Kyneton
2855	Eales, F.	Bell-street, Penshurst
2852	Easton, Miscamble and Co.	533 Collins-street, Melbourne
2879	Egan, F. H. ..	High-street, Avoca
2793	Elias, E. R. ..	389 David-street, Albury, New South Wales
2861	Ellis, J. M. ..	39 Robert-street, Essendon
2889	Erwin, V. P. ..	Lake-street, Natimuk
2777	Evans, C. J. ..	83 French-street, Hamilton
2840	Evans, W. J. ..	Victoria-street, Boort
2836	Ferguson, F. S. McN.	76 McIvor-road and Market-street, Bendigo
2762	Ferris, R. J. ..	Port Fairy-road, Warrnambool
2727	Flanigan, J. ..	Murray-street, Colac
2858	Forbes, A.	Harrow
2758	Gilfuis, W. P. ..	Main-street, Rutherglen
2843	Gillespie, R. D. ..	17 Sutherland-street, Coburg
2841	Glover, W. H. ..	Majorca-road, Carisbrook
2839	Gordon, C. G. ..	313 King-street, Melbourne
2784	Gordon, K. C. ..	James-street, Yarram
2857	Green, T. W., and Co. Pty. Ltd.	Therry-street, Bombala, New South Wales, and Bombala-street, Delegate, N.S.W.
2874	Hardy, F. A. ..	Myamyn
2736	Hargreaves Bros. Pty. Ltd.	Ararat, and at Willaura
2867	Hargreaves, J. R. ..	Terang-road, Mortlake
2844	Harris, L.	Lower Main-street, Stawell
2837	Harvey, R. C. ..	101 Mercer-street, Geelong
2796	Hately, R. N. ..	Manangatang
2859	Haughton, W., and Co. Pty. Ltd.	545 Little Collins-street, Melbourne
2754	Heddle, R. L. D. M.	4 Wellington-street, Kerang
2865	Hendy, A. W. ..	30 Grundy-grove, Pascoe Vale South
2741	Hicks, J. T. ..	Goroke
2824	Hill, Duncan and Son	6 Phillips-street, Warracknabeal
2767	Hofbauer, F. ..	35 McIlwraith-street, North Carlton, N.4
2768	Holdsworth, R. M. ..	Boinka
2881	Holdsworth, W. ..	Beaufort
2838	Irwin, F. J. ..	39 Richmond-crescent, East Geelong
2853	Jackson, J., Pty. Ltd.	2 Main-street, Bairnsdale
2737	James, D.	199 Boundary-road, North Melbourne
2892	Jobe, C. E. ..	Lower Main-street, Stawell
2790	Johnson, A. P. ..	Station-street, Lake Boga
2866	Johnson, P. F. and J. E.	Adelaide-road, Pinnaroo, South Australia
2900	Jones, A.	Delegate, N.S.W.
2891	Jones, E. V. ..	Harrow
2765	Kennon, J., and Sons Pty. Ltd.	63 River-street, Richmond
2779	Kewin, R. F. ..	Wheeler-street, Corryong
2813	Kilroy and Story ..	High-street, Heathcote
2750	Lindsay, D. H. ..	Railway Yard, Jeparit
2732	Lockwood and Sons Pty. Ltd.	Cumming-avenue, Birchip
2873	Long, C. J. ..	12 Campbell-street, East Kew
2771	McAree, Mrs. M. G.	Cr. High and Warren streets, Echuca
2869	McClintock, A. E. ..	Bowen-street, Digby
2786	McDonald, I. A. ..	Jardine-street, Corryong
2886	McGauchie, A. A. J.	Main-street, Cobram
2752	McGuire, L. ..	Spencer-street, Albury, N.S.W.
2743	McLaren, W. J. ..	24 Baynes-street, Terang
2850	McLean, A., and Son	Smythe-street, Benalla
2776	McLennan, D. ..	Webster-street, Wycheproof
2757	McLennan, D. J., and Son	Best-street, Sea Lake
2769	McMillan, R. H. ..	41 Gibney-street, Maffra
2903	McVitty, J. H. ..	57 McMahon-street, St. Arnaud
2748	Marshall, G., and Donnelly	Edenhope
2828	Mitchell, K. R. ..	McIvor-road, Bendigo
2862	Moar, M. A. ..	Cemetery-road, Dimboola
2835	Moore, D. R. ..	Hamilton-street, Kilmore
2849	Morey, H. I. ..	McDonald-street, Numurkah
2726	Moynihan, J. P. ..	De Boos-street, Euroa
2833	Munday's Distributing Co.	41 Moorabool-street, Geelong, and at Murray-street, Colac, Brook-street, Camperdown, Portland, and Heywood
2738	Murphy, D. A. ..	666 Burke-road, Camberwell
2856	Murphy, T. H. ..	High-street, Seymour
2896	Murrell, H. ..	Murray-street, Casterton
2731	Murrells and McNicol	122 Napier-street, St. Arnaud

LICENSED SKIN BUYERS—*continued.*

Licence No.	Holder of Licence.	Business Address.
2766	New Zealand Trading Co. Pty. Ltd.	514 Flinders-street, Melbourne; and at Maybe-street, Bombala, N.S.W.
2848	Nicklen, T. E. ..	Talbot-road, Maryborough
2830	Niddrie, L. G. ..	27 Lonsdale-street, Hamilton
2751	North Western Wool and Skin Stores	Gummow-street, Swan Hill
2897	Nulty, B. A. ..	Dartmoor
2842	O'Beirne, D. J. ..	Commercial-street, Kaniva
2740	O'Beirne, J. and F.	Linton
2899	O'Beirne, J. D. ..	Hamilton-street, Horsham
2864	O'Donnell, J. A. ..	Renmark, S. A.
2885	Oliver, R. A. ..	13 Burns-street, Yarraville
2847	Oppenheim, W. ..	21 Peel-street, North, Ballarat
2781	Parker, S. K. ..	Cr. Hovell and Elgin-street, Wodonga
2904	Peach, A. C. J. ..	High-street, Macarthur
2780	Penney, F. H. ..	3 Balaclava-street, Ballarat
2834	Penney, H. ..	422 Ascot-street, and 3 Balaclava-street, Ballarat
2759	Perkins, C. T., Ltd.	Robertson-street, Naracoorte, S.A.
2739	Permezel, Y. A. ..	High-street, Yackandandah
2825	Perry, A. J. ..	Prince's Highway, Colac West
2734	Pickthall, J. W. ..	4 Silvermines-road, St. Arnaud
2884	Poowong Produce Co.	Nyora
2817	Prevost and Co. Pty. Ltd.	555 Little Collins-street, Melbourne
2804	Pyramid Co-op. Soc. Ltd.	Kelly-street, Pyramid Hill
2797	Reason, C. ..	Pekin-road, Maryborough
2729	Rehfisch, H. K. ..	223 Mair-street, Ballarat
2890	Reid, A. N. ..	Port Fairy-road, Hamilton
2898	Rice, F. E. ..	Hamilton-road, Macarthur
2803	Rice, J. P. ..	Murtoa
2733	Rice, J. W. ..	315–317 Mair-street, Ballarat
2789	Rich and Gross ..	Brougham-place, Geelong
2863	Richards, E. R. ..	1 Northwestern-road, St. Arnaud
2882	Richards, J. J. ..	42 Crimea-street, Caulfield
2878	Richards, W. R. ..	9 Augusta-street, Glenhuntly
2811	Rodda, L. F. ..	Railway Yards, Beulah
2809	Ross and Brewster Pty. Ltd.	1 Little Curran-street, North Melbourne
2787	Ross, J.	61 Gaffney-street, North Coburg
2895	Ross, J. A. ..	Walwa
2815	Russell, R... ..	Colac West
2880	Segrave, W. F. ..	Yaapeet
2826	S.E. Wool and Skins Ltd.	Sturt-street and Bay-road, Mt. Gambier, S.A.
2846	Sharrock, C. H. J. ..	Bessiebelle
2801	Short, I. W. ..	George-street, Hamilton
2799	Sims Cooper (Freezing Works) Pty. Ltd.	Newport Freezing Works, Newport; Corio Freezing Works, North Geelong; Oriental Scouring Mills, North Geelong
2902	Sly, C.	Walpeup
2778	Smorgon, N., and Sons Pty. Ltd.	Somerville-road, Brooklyn
2798	Stanley, J. S. ..	Brougham-place, Geelong
2829	Stanton, J. ..	Nelson-street, Nhill
2812	Stevens Bros. ..	Rosebery
2742	Stokes, C. B. ..	Bendoc
2802	Sutton, Mrs. J. S. ..	Havelock-street, Beaufort
2792	Taylor, H. G. ..	Cumming-avenue, Birchip
2805	Teasdale, R. L. ..	Charlton
2893	Thomas, F. ..	Tintaldra
2775	Thomas, S. S. ..	Cr. Wattle and Victoria streets, Bendigo
2795	Thompson, W. L. ..	Melbourne-road, Yea
2807	Tolson, L. M. ..	Korumburra; and at Mirboo North
2808	Victorian Inland Meat Authority	54 Market-street, Melbourne; and at Ballarat and Bendigo
2782	Vines, A. A. ..	Bromley-road, Robinvale
2814	Waters, S. H., and Co. Pty. Ltd.	Benalla, Wangaratta, Hamilton, Casterton, Coleraine, Horsham, Ararat
2870	Wheatland, W., and Co.	Brougham-place Geelong
2746	Wheaton, C. M. ..	Miram
2735	Wheeler, R. H. ..	Hannan-street, Sea Lake
2783	Wilcox Mo'lin Ltd.	Cr. Footscray and Dynon roads Footscray
2832	Wingfield, E. H. ..	Williams-street, Charlton
2773	Wray, L. N. ..	79–81 Malop-street, Geelong
2794	Wright, N. A. ..	High-street, Shepparton
2822	Young, H. ..	Orford
2888	Young's Blue Store Pty. Ltd.	Cumming-avenue, Birchip
2871	Zed, A., and Sons ..	Commercial-street, Mt. Gambier, S.A.

Apricot Scab

In tests conducted by the Department in the Goulburn Valley over a period of three years, thorough spraying with Bordeaux mixture 6 : 4 : 40, applied just as the final leaves were falling (about the end of May), and again at the pink bud stage (about the middle of August), reduced the percentage of apricot fruits infected with scab from 77 per cent. on unsprayed trees to 2 per cent. on trees which had received the Bordeaux spray.

To prepare the spray mixture, dissolve 12 lb. of finely crystalline copper sulphate in 72 gallons of water in an 80-gallon spray vat. Then mix 12 lb. of hydrated lime with gallons of water, start the agitators on the vat and slowly pour in the lime solution.

If a small quantity of the spray (say 10 gallons) is required make up as follows:—Dissolve 1½ lb. of copper sulphate (the crystalline form dissolves more readily) in 5 gallons of water in a non-metallic vessel. In another vessel dissolve either 1½ lb. of hydrated lime or 1 lb. of quick lime in another 5 gallons of water. Then mix the two solutions together by pouring into a third non-metallic vessel. Spray out immediately.

[Contributed by the Biological Branch.]

Irrigated Pastures in Victoria

By A. MORGAN, B.Agr.Sc., Senior Irrigation Officer

Part 1 of this series appeared in the March issue, and Part 2 in the May issue of this Journal

NOTES ON THE PRINCIPAL PASTURE SPECIES

MEASUREMENTS of the yield and botanical composition of irrigated pastures at the State Research Farm commenced in 1929.

During the investigations it was necessary for all concerned to develop the capacity to recognize the individual grass and clover species, weeds, and weedy grasses at all stages of growth, and sometimes with only as much as a single leaf available for examination.

This was a most interesting side-track, and one which proved invaluable to all concerned when they attended field days, pasture competitions, and the like, or were handed very fragmentary specimens for identification.

Experimental plots on the property of Mr. J. B. Mann, Appin. Lucerne, left; Rhodes grass, right.

The grasses common in irrigated pastures did not, of course, include many native species. Such grasses as "root grass" (Danthonia species) showed such wide range in vegetative characters that any reasonably simple key was out of the question. However, a key to the most common species was published in the July, 1933, issue of the Journal of the Department of Agriculture.

The clovers being more limited in number and, generally speaking, more distinctive in regard to vegetative characters, were also examined in detail and a satisfactory key was published, together with illustrated descriptions of all the common clovers, in a booklet—"Clovers and Allied Species"—which may be obtained free of charge on application to the Director, Department of Agriculture, Melbourne, C.2. Illustrated pamphlets on the more common grasses are also obtainable.

The main points to be considered are:—

(*a*) Methods of identifying the different species of grasses and clovers.

(*b*) Utilitarian considerations such as growth cycle, palatability, adaptability to varied irrigation practice, and varied soil types, value for fodder conservation, and so on.

In regard to identification, the bulletin and pamphlets mentioned in Part 2 of this series published in the May issue of this Journal, are essential for reference to details.

As the key to the grasses is out of print, it seems desirable to reproduce it here in an abridged form.

IDENTIFICATION METHODS

Methods of identification of grasses in the field, in the absence of seed heads, are based mainly on the following characters:—

(*a*) HAIRY OR NOT HAIRY.—

The presence or absence of hairs is easiest determined by holding the specimen up to direct light. If present, hairs may be seen on only one side of the leaf-blade, or both; in some grasses, the hairiness is confined to the leaf-sheath or to the base of the plant, or to the leaf margins.

(*b*) Creeping Stems or not.—

Such grasses as couch grass, Paspalum distichum, Rhodes grass, Kentucky blue grass, Kikuyu grass, Buffalo grass are obviously distinct from erect grasses such as rye grass, cocksfoot, Paspalum dilatatum.

(*c*) The Size and Construction of the Ligule.—

The ligule is usually a flap of tissue, normally not green but transparent, at the junction of the leaf-blade and the leaf-sheath. In canary grasses, the ligule is very long. In other grasses, such as Wild Millet (Barnyard grass), it is very much reduced in size, and in others it may consist of a semi-circle of hairs.

(*f*) Whether the Leaf Surface is Shining or Dull.—

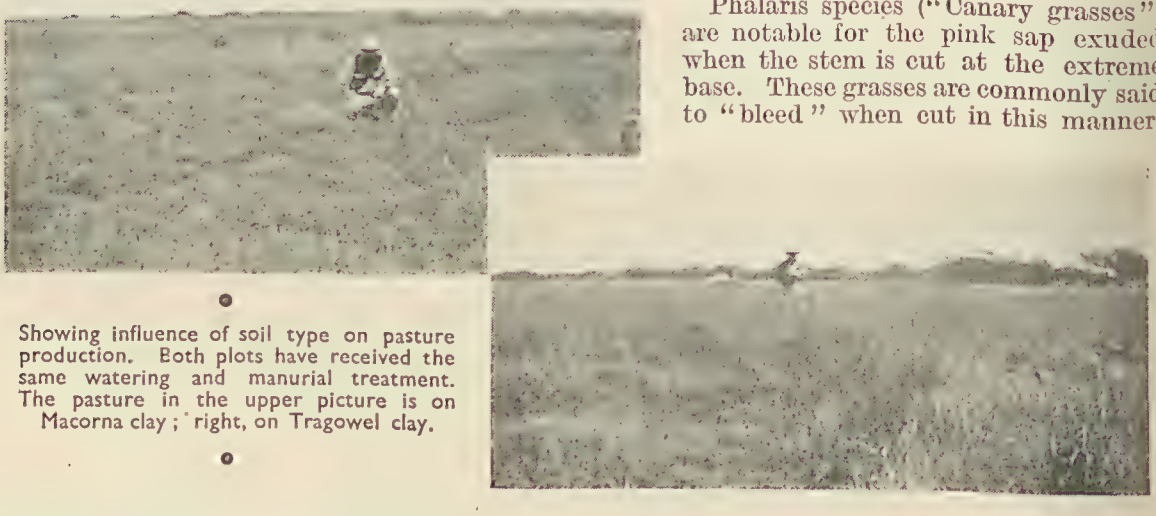
Rye grasses, for example, are shining on the back of the leaf but dull and ribbed on the front (or upper) leaf surface. This feature is sufficiently distinctive to enable one to recognize a rye grass paddock, (provided the day is not dull), from a travelling motor car.

(*g*) The Shape of the Tip of the Leaf.—

Some grasses, notably those belonging to the genus Poa ("Meadow grasses," "Blue grasses"), have a boat-shaped leaf-tip; some grasses have the midrib of the leaf projecting as a point (mucro). The common "summer grass" or "windmill grass" (Chloris truncata) is a good example. Others such as rye grass have a tapered leaf-tip.

(*h*) Colour of the Sap.—

Phalaris species ("Canary grasses") are notable for the pink sap exuded when the stem is cut at the extreme base. These grasses are commonly said to "bleed" when cut in this manner.



Showing influence of soil type on pasture production. Both plots have received the same watering and manurial treatment. The pasture in the upper picture is on Macorna clay; right, on Tragowel clay.

(*d*) The Width and Venation of the Leaf.—

Broad-leaved grasses, such as Phalaris tuberosa, cocksfoot, and Paspalum dilatatum, are usually readily distinguishable from narrow-leaved plants such as rye grasses, couch grass, Kentucky blue grass, &c.

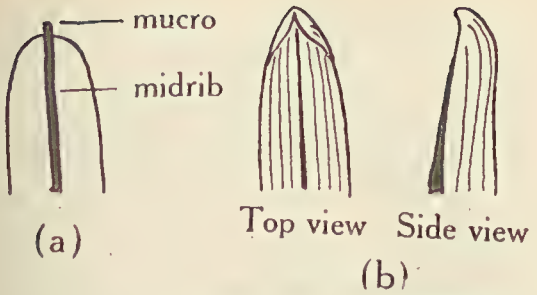
With regard to veining of the leaf, the so-called "tram-line" venation of Kentucky blue grass is distinctive in sown pasture, though some Wallaby grass types (Danthonia spp.) show a similar construction.

(*e*) Whether the Emerging Leaf is Rolled or Folded.

This is frequently used as a guide to distinguish the perennial from the "false perennial" and annual types of rye grass.

(*i*) Nature of the Old Leaf-sheath at the Base.—

This has a distinctive colour in one or two species. This character is not to be confused with the colouration of the living portion of the stem-base, which, for example, is very often reddish or purplish in the case of rye grass, the degree of colouration and the extent to which it is obvious up the stem being loosely related to the annual character of the plant. Wimmera rye grass, for example, shows in general more extensive and deeper colouration than certified perennial rye grass.



Differences in shape of leaf tip: (*a*) Windmill grass, (*b*) Kentucky blue grass.

(*j*) Annual or Perennial.—

It is not easy to determine this, particularly if the pasture being examined is from a recent sowing, so it is relied on as little as possible as a means of identification.

(*k*) The Presence of Auricles.—

There is no common name for the auricle, which is a small stem-clasping organ at the junction of leaf-blade and leaf-sheath. The largest auricles are seen on cultivated barley, on barley grass, and a few other species, while other grasses (cocksfoot, for example) have no auricles.

The following key makes use of the characters described above, but does not include all the grasses which occur; any conclusion arrived at by use of the key should be confirmed by reference to a full description of the particular species.

(1) Grass spreading above ground by means of creeping stems—see (2).
Grass not spreading by means of creeping stems—see (4).

(2) Hairy at junction of blade and sheath—see (3).
Not hairy at junction of blade and sheath—*Creeping Bent.*

(3) Creeping stems thick, young leaves hairy on under surface, two spikes in the head—*Paspalum distichum.*
Creeping stems fine (about $\frac{1}{16}$th inch), young leaves hairless on blade, about five spikes in the head—*Couch grass.*

(4) Not hairy on blade or sheath (exclusive of junction of blade and sheath)— see (5).
Hairy on blade or sheath—see (15).

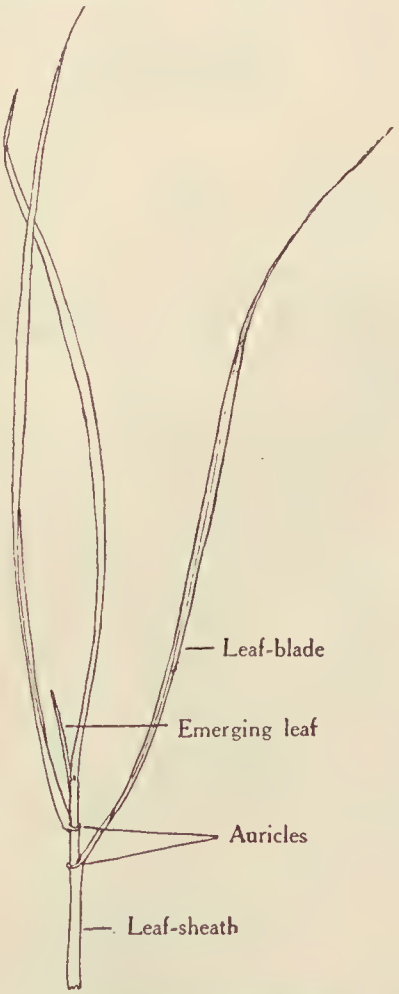
(5) Auricles present—see (6).
Auricles absent—see (7).

(6) Emerging leaf-blade folded—*Perennial rye grass.*
Emerging leaf-blade rolled—*Annual or Intermediate Type of rye grass.*

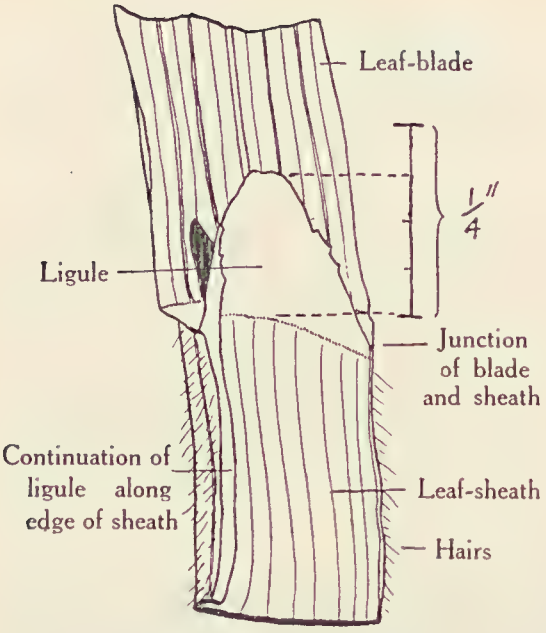
(7) Leaf-blade narrow (up to $\frac{1}{8}$th inch)—see (8).
Leaf-blade broad (about $\frac{1}{4}$ inch)—see (13).

(8) Ligule of short hairs—see (9).
Ligule of long hairs—*Desmazeria.*
Ligule absent—see (10).
Ligule membranous, short (not more than $\frac{1}{8}$ inch)—see (10).
Ligule membranous long ($\frac{1}{4}$ to $\frac{1}{2}$ inch)— see (12).

(9) Seeds without hairs—*Graceful panic grass.*
Seeds very hairy—Plain grass (*Eriochloa*).



Stem of rye grass showing parts useful in grass identification.



Ligule of Prairie grass, enlarged.

(10) Leaf-tip blunt, with mucro—*Summer (or Windmill) grass or Umbrella grass (Chloris).*

Leaf-tip boat-shaped—see 11.

(11) Perennial with spreading underground rootstocks—*Kentucky blue-grass.* Annual, pale green—*Winter grass (Poa annua).*

Tall, tussocky, in moist situation—*A Wallaby grass (Danthonia).*

(12) Leaf-blade fine, lax—*Blown grass (Calamagrostis).*

Leaf-blade erect, strong—*Swamp Wallaby Grass (Amphibromus).*

(13) No ligule—*Barnyard grass (Wild Millet).*

Ligule long, sap at base of stem pink—*Canary grass.*

Ligule short—see (14).

(14) Emerging leaf-blade folded—*Cocksfoot.*

Emerging leaf-blade rolled—*Paspalum dilatatum.*

(15) Hairs covering blade and sheath, giving downy appearance; pink veins at base of stem—*Yorkshire fog.*

Hairs on leaf-blade only—see (18). Numerous short hairs on blade and sheath—see (16).

Few long hairs along margins of sheath and blade, or on the upper surface of the leaf-blade just above of blade and junction sheath—see (17).

(16) Conspicuous tufts of long hairs at sheath-blade junction—*Wallaby grass (Danthonia).* No tufts of hairs at junction of blade and sheath—*Brome grass.*

(17) Narrow-leaved, mat-forming plant—*Bent pigeon-grass (Setaria).*

Broad-leaved, erect, annual plant—*Green pigeon grass and Pale pigeon grass (Setaria species).*

(18) Auricles present—*Barley grass.*

Auricles absent—*Brome Fescue (Silver grass).*

Utilitarian considerations such as growth cycle, palatability, adaptability to varied irrigation practice and varied soil type, value of fodder conservation, and so on, are of more immediate interest to the irrigator; and the following brief notes sum up the advantages and disadvantages of each of the major grass species in general use.

When comparing his own experience of any particular species, with the statements made here, the irrigator should take particular notice of the "strain" referred to in each case. The introduction of seed certification in Victoria is of comparatively recent origin, and it is likely that there are certain irrigators who still do not allow the consideration of strain of the grass sown to carry its proper weight when buying seed for pasture sowing. Those who buy a ready-mixed lot of seed should not expect to obtain the same satisfaction from their pastures as those who buy suitable certified seeds and make up their own mixture.

In these notes the various strains obtainable commercially will be indicated for each species.

PERENNIAL RYE GRASS

Perennial rye grass, taking everything into consideration, remains a most useful perennial grass under irrigation. Its production is notably highest in the autumn-winter-spring period, but, with proper watering treatment, it continues to produce palatable and leafy feed through the summer. On some of the poorer soil types (e.g., the "red plain" such as Macorna clay) it may develop a tufty character, but invariably this

will be found to be associated with other factors, such as inadequate topdressing, overgrazing, or inadequate watering.

It grows best in association with clovers, and the technique which produces the best growth of clover will at the same time give high production from the rye grass.

It makes a first-class pasture hay, and from the point of view of conditions for curing and the routine of other jobs on the dairying or fat-lamb property, its maximum production of hay normally occurs at a suitable time. Rust is the only particularly important disease in the northern irrigation districts, and this is usually associated with lateness in harvesting.

In normal times, seed of three Victorian certified strains is available in abundance—these are Kyneton, Clunes, and Colac. Of the three, although there is not a great deal of difference in performance, Clunes strain (certified) appears to be the most generally suited to northern irrigation conditions. Ten to fifteen lb. per acre, according to the amount of other seeds to be sown in the mixture, is sufficient. In some seasons, a disease reduces the germinability, but, with the certification scheme, the irrigator is protected in regard to the sale of unsatisfactory seed. Uncertified Dingee rye grass is commonly sown.

In spite of the disability of tuftiness often commented on when perennial rye grass is sown on poor soil and not given satisfactory manurial and irrigation treatment, it must be emphasized that the other commercial species will also show up poorly if subjected to the same conditions.

With regard to fodder value, it is advisable for those interested in this aspect to obtain from the Department of Agriculture a copy of "Foods and Feeding", a bulletin issued free of charge by the Department. Analyses of a large number of species and mixtures are shown for comparison.

Perennial rye grass seed samples vary a good deal with season, &c., but, allowing a quarter of a million seeds to the lb., the maximum number of plants obtainable per square foot with a 10-lb. per acre sowing (assuming even distribution) is 55. This is obviously more plants that can find room to grow on a square foot. Even allowing for the comparatively low field-survival common with most sowings, there is usually more than enough rye grass, and the problem is to manage it so that the light-demanding species (such as white clover) and the species with slower root-establishment characteristics (such as cocksfoot) are not smothered. This can happen in a wet spring when the new pasture is too soft and wet for the grazing of heavy animals. Consequently, the 15 lb. per acre seeding referred to in the first article of this series would not be used except in cases where the usual 5 lb. of cocksfoot per acre is omitted.

COCKSFOOT

Cocksfoot, at first, was not received very well in the northern irrigation districts. The main argument against this grass was that the climate was supposed to be too hot to suit it.

It has been shown however that a hot climate is no bar whatever to its development. In fact, on plots conducted by the Department at Swan Hill, Tragowel, Tinamba,

Perennial rye grass (Lolium perenne, L.) Note the absence of awns on the seedhead.
[After Breakwell.

Cocksfoot (Dactylis glomerata, L.)
[After Hitchcock.

Stanhope, Appin, &c., the cocksfoot in some parts of the permanent pasture area is the dominant species. The type of management best suited to cocksfoot was demonstrated at the State Research Farm, Werribee, in two sets of trials, viz., Frequency of Cutting Test and Frequency of Watering Test.

In the Frequency of Cutting trial, which will be dealt with in more detail later, the cocksfoot percentage rose from 25·4 per cent. (average during 1933–37) on the "cut weekly" plots to 40 per cent. on the "cut monthly" plots. As the yields of dry matter on these plots were 322·9 lb. and 401·6 lb. respectively from ·045 acre plots, it is clear that an increase in the productivity of the cocksfoot resulted from a system of cutting which simulated lenient grazing at reasonably wide intervals. In regard to watering treatment, to quote one instance from the many available, the cocksfoot represented 26·7 per cent. of the herbage on the "six waterings of 3 inches" as compared with 16·7 per cent. on the "three waterings of 6 inches" (seasons 1929–31). It is obvious from these results that the adoption of good management in regard to irrigation and grazing has a profound effect on the productivity of these species.

An intensive study of cocksfoot (*Dactylis glomerata*) has been made during the last twenty years by the staff of the Welsh Plant Breeding Station, Aberystwyth, under the direction of Professor Stapledon, and summaries of this work may be found in Herbage Abstracts issued during that period. In New Zealand, similar studies were made by Dr. Wm. Davies, E. Bruce Levy, and others. Work in Victoria was conducted for the Department of Agriculture, at Burnley, by J. E. Harrison, F. R. Drake, and, latterly, by W. D. Andrew.

Strain investigations included commercial (Danish) seed, certified New Zealand Akaroa cocksfoot, Gippsland cocksfoot, &c. A detailed account by F. R. Drake, was published in the November, 1940, *Journal of Agriculture*; Mr. Drake gave Victorian cocksfoot as equal, if not superior, to the New Zealand strains in desirable pasture characters such as leafiness and persistency. A further account by Mr. Drake in July, 1942, mentioned that New Zealand Lincoln College lines of cocksfoot

Good hay can be made from pasture which includes cocksfoot.

appeared to have lost some of the vigour and size exhibited by Victorian and ordinary New Zealand strains.

In No. 6 of the series "Pasture Plants of Victoria", W. D. Andrew supplies much interesting information in regard to (*a*) uses of cocksfoot outside the irrigation areas; (*b*) methods of harvesting the seed; (*c*) botanical characters. The remarks in regard to the root-system are:—"In vigorous plants this may extend to a depth of more than 3 feet, but 50 per cent. of the roots would be in the top 12 inches. Plants weakened by overgrazing may have quite a shallow root system, and, consequently, can be pulled out quite easily." In regard to varieties of the grass, he mentions the following:—

(*a*) A variegated variety occasionally grown as a garden border plant.

(*b*) Var. *hispanica*—short branches in the panicle (flower-head).

(*c*) Var. *maritima*—with dark-violet panicle.

(*d*) Var. *abbreviata*—compact panicle.

(*e*) Var. *ciliata*—hairy leaf-sheaths and hairy lemmas (the lemma is one of the flowering glumes).

Mr. Andrew also mentions that the standard bushel weight by agreement is fixed at 20 lb. in Australia, and that the number of seeds per lb. varies from 400,000 to 600,000. So that a 5-lb. per acre sowing would give a maximum plant population of 44 to 56 per square foot. In practice, four or five plants to the square foot may persist and as the pasture ages an individual plant may occupy this area through lateral enlargement.

A luxuriant growth of irrigation white clover.

Its main growth is in the spring, but, with the favorable moisture conditions provided by efficient irrigation, its activity extends through to the winter. For dairying, the presence of somewhat rank growth at the beginning of winter is not particularly detrimental, as the stock gradually trim it down as feed becomes scarcer, but dry rank growth soon loses its fodder value due to rain. An early summer clipping with the mower is therefore advisable.

In its first season, cocksfoot is susceptible to competition from rye grass and for best results, the amount of perennial rye grass sown in a mixture with it should not exceed 10 lb. per acre.

Taking everything into consideration, cocksfoot is close to perennial rye grass in value for irrigation pastures in this State, and should be left out of the permanent pasture mixture only in those areas where problems of irrigation water supply operate against its successful use.

A fourth instalment of this article will appear in a subsequent issue of the Journal.

Fruit-tree Pruning Demonstration

A fruit-tree pruning demonstration, in conjunction with the Royal Horticultural Society, will be given by the staff of the School of Horticulture, Burnley, on Saturday, 2nd July, at 2.30 p.m. The demonstration is free.

The Burnley Gardens are situated in Swan-street, Richmond, near the Hawthorn tram depot. Wattle Park and Burwood trams from Batman-avenue, City, stop at the gate.

Insecticides, Fungicides, Weedkillers and Sheep Dips

Brands Registered for 1949

By W. R. Jewell, M.Sc., Chief Chemist

THE *Fungicides Acts* 1928 and 1935 control the sale of insecticides, fungicides, weedkillers, and dips in this State. In line with legislation concerned with other agricultural products, these Acts require the registration of a brand and the labelling of all packages with certain information, which includes the registered brand and the nature and amount of active ingredients.

It is an offence to sell an unregistered material, or one that does not comply with the analysis on the label nor with a standard, if such has been prescribed. The responsibility for effecting registration and ensuring that the product is up to standard rests with the "wholesale dealer", who is defined as the person primarily responsible for placing the product on the market in Victoria.

Registrations are annual and a registration is valid only from the publication of one list of registered brands to the next. Inspections are made of stocks of pest destroyers, &c., and samples are taken for analysis, to check whether the material is in accordance with its guarantee. The Acts, therefore, are designed primarily for the protection of the purchaser although they are also of benefit to the bona fide manufacturer.

The list of registered brands for 1949, which appears in the concluding pages of this issue, should be of considerable interest to most primary producers. Its retention for future reference is recommended. The list covers nearly 500 different brands which are grouped into a number of classes for convenience. Many of the classes cover long-established types of material, familiar to farmers for many years. The list includes some of the newer types of insecticide, as well as mixtures and miscellaneous products.

DDT

There has been a further increase in the number of brands containing DDT, which is now almost as well known as, say, lead arsenate. The uses to which DDT powders and solutions can be successfully put have not extended greatly, but the number of types of such preparations, and the quantity used, have increased considerably. An uneasy note is sounded in recent overseas literature, in particular from America, on the toxic effect of residual amounts of DDT on fruit and vegetables. The picture is not yet clear, but the evidence suggests that this chemical may be more toxic than was originally thought. In Victoria, the sale of fruit or vegetables containing more than 10 parts per million of DDT is prohibited under Health regulations, and this is considered to be an adequate safeguard.

"DDT" is short for the organic chemical, dichloro-diphenyl-trichloroethane, which can be present in two almost identical forms or isomers, only one of which—the para para isomer—is effective as an insecticide. As different grades of commercial DDT contain different proportions of this isomer, the total amount of DDT in an insecticide may be misleading; all DDT products must therefore state the guaranteed analysis in terms of the para para, and active, isomer.

Benzene Hexachloride

There is also an increase in the number of brands of material, including sheep dips, which contain another new organic chemical —benzene hexachloride—referred to also under certain trade names such as Gammexane and 666. This particular chemical may contain four different isomers, of which the gamma one is the most active; the guarantee in respect to benzene hexachloride is therefore made in terms of the percentage of the gamma form present.

In general, the published list of brands should be self-explanatory. However, if the reader requires any more detailed explanation, or advice on any chemical aspects of pest destroyers, this will be given on application to the Chemist for Agriculture, State Laboratories, Melbourne.

Otway Potato Plot Competition, 1948-49

Report of the judge, G. H. Mattingley, Dip. Agr. (Dookie), Potato Expert

First and third places in the Otway potato plot competition for 1948-49 were taken by Messrs. J. Knox and Son, Weeaproinah, with Mr. Jos. Butler filling second place. In winning this year's competition, Messrs J. Knox and Son have now won outright the Silver Cup donated by Mr. L. G. Kappe.

Harvesting potatoes on the property of Messrs. J. Knox and Son, Weeaproinah

THE current potato season in the Otway District began particularly well, and the greater part of the crop was sown during the latter part of November and early December under ideal weather conditions. The strike was good and with excellent weather during the month of January, crops made rapid growth. But February opened cold, wet and windy and growth came almost to a standstill. Cold conditions prevailed for the rest of the season and crops appeared to be below standard, but when harvest commenced early in May it was found that the majority would yield in excess of expectations. The estimates of yield of the plots entered in the competition confirmed this—some crops yielded up to 16 tons per acre—and it is expected that, overall, the district will average 8 tons per acre.

The first inspection of plots entered in the competition, was made during the week beginning February 28th, and details of the points awarded are set out in Table 1. At that time the crops were in full flower and, apart from a small amount of bacterial wilt, looked promising.

The final inspection and estimation of yield were made during the week beginning May 2nd. The method adopted in assessing the yield was to take a number of small samples at random over the area of the plot. All marketable tubers above 1½ inch in diameter were weighed and the yield estimated by taking the average weight of the samples harvested.

It should be noted that the entry yielding the highest tonnage per acre is given full points for weight, the others being awarded points on a pro-rata basis. At the close of the field judging the samples were assembled and given points for type, texture and whiteness of flesh, and freedom from disease and defects.

The aggregate of points awarded at the first and final inspections are listed in order of merit in Table 2.

THE WINNING CROP

The winning crop, the only one of the Katahdin variety entered, was grown by Messrs. J. Knox and Son, Weeaproinah. During the season, the crop provided an excellent example of the attention which these growers give their crops and which has placed them among the leaders in the Victorian seed potato trade. The crop was even, free from disease, true to type and well cultivated. The sample harvested from the crop was a feature of the competition ; a very even run with no waste and no oversize tubers. On cutting, several tubers were found with internal discolouration, and points were deducted on this accouut, but subsequent examination showed that this trouble was not general in the crop.

The Silver Cup competed for in this competition was donated in 1933, by Mr. L. G. Kappe, at one time bank manager at Beech Forest. To become the property of a grower the Cup has to be won three times, not necessarily in succession. As Messrs Knox and Son have won the competition on two previous occasions, in 1940, and in 1948, they have now won the competition outright and will retain the Kappe Cup.

TABLE 1.—POINTS AWARDED AT FIRST INSPECTION, OTWAY POTATO PLOT COMPETITION

Name.	Variety.	Freedom from Disease.	Evenness and Vigour.	Varietal Purity.	Cultivation.	Total.
Possible Points	.. .. ..	30	30	20	20	100
Brown, D. and C.	Sebago	14	18	20	12	64
Butler, J.	Sebago (1)	25	22	20	18	85
	Sebago (2)	25	23	20	18	86
Deppeler Bros	Sebago	23	26	16	17	82
Edwards, A.	Sebago	25	24	20	17	86
Francis, J.	Late Carman ..	24	24	20	18	86
Hobson, J.	Sebago	20	22	20	18	80
Knox, J and Son	Sebago (1)	27	27	20	19	93
	Sebago (2)	27	27	20	18	92
	Sequoia (1) ..	27	28	20	19	94
	Sequoia (2) ..	27	28	18	19	92
	Katahdin	28	27	20	19	94
Minchinton Bros.	Sebago	23	24	20	18	85
Minchinton, E. A.	Late Carman ..	23	25	20	18	86
	Sebago	23	22	20	17	82
	Sequoia	26	25	20	18	89
Minchinton, E. F. and Son ..	Late Carman (1) ..	22	26	20	18	86
	Late Carman (2) ..	23	24	20	16	83
	Up-to-Date.. ..	24	24	18	18	84
	Sequoia	25	22	20	18	85
Murchison, A. M. J.	Up-to-Date.. ..	24	24	20	17	85
	Late Carman ..	24	25	20	17	86
Parker, S.	Late Carman ..	25	24	18	14	81
Puls, A. B.	Sebago	25	22	16	16	79
Tann, W. H.	Sequoia	26	23	20	18	87
	Sebago	24	25	18	17	84
Towers, A. J.	Late Carman ..	26	25	20	18	89
Westbury, V. R.	Up-to-Date.. ..	25	25	18	16	84

A crop of certified seed potatoes in the Beech Forest district.

Table 2.—Points Awarded at Final Inspection, in Order of Merit

Grower.	Variety.	Rows per Chain.	Estimated Yield.	Points for Yield.	Size, Type, and General Appearance.	Texture of Flesh.	Whiteness of Flesh.	Freedom from Defects.	Total.	Points Awarded at First Inspection.	Grand Total.
Possible Points ..	.. ..	..	..	40	20	20	10	10	100	100	200
			tons. cwt.								
Jos. Knox and Son, Weeaproinah	Katahdin ..	26	14 8	34.3	19	17	8	6	84.3	94	178.3
Jos. Knox and Son, Weeaproinah	*Sequoia (2) ..	29	16 8	39.0	17	16	5	8	85.0	92	177
Jos. Butler, Weeaproinah	Sebago (2) ..	30	15 12	37.1	16	18	8	8	87.1	86	173.1
Jos. Knox and Son, Weeaproinah	Sebago (2) ..	29	13 0	31.0	16	17	7	9	80.0	92	172
W. H. Tann, Weeaproinah	*Sequoia ..	27	15 10	36.9	15	14	6	10	81.9	87	168.9
E. A. Minchinton, Weeaproinah	*Sequoia .	31	14 0	33.3	14	16	7	8	78.3	89	167.3
A. Edwards, Ferguson	Sebago ..	28	13 14	32.6	16	17	6	8	79.6	86	165.6
E. A. Minchinton, Weeaproinah	Late Carman	26	11 10	27.4	16	17	9	8	77.4	86	163.4
Deppeler Bros., Beech Forest	Sebago ..	30	16 16	40.0	10	15	8	8	81	82	163
Minchinton Bros., Ferguson	Sebago ..	27	12 2	28.8	17	16	6	9	76.8	85	161.8
A. M. J. Murchison, Ferguson	Late Carman	28	10 11	25.1	15	17	10	8	75.1	86	161.1
E. F. Minchinton and Son, Beech Forest	Late Carman (2)	26	11 7	27.0	16	18	9	8	78.0	83	161
V. R. Westbury, Wyelangta	Up-to-Date ..	23	14 9	34.4	14	15	5	7	75.4	84	159.4
A. M. J. Murchison, Ferguson	Up-to-Date ..	27	13 1	31.1	14	14	5	8	72.1	85	157.1
E. F. Minchinton and Son, Beech Forest	*Sequoia ..	30	11 8	27.1	14	16	8	7	72.1	85	157.1
A. B. Puls, Beech Forest ..	Sebago ..	29	13 3	31.3	15	15	8	8	77.3	79	156.3
E. F. Minchinton and Son, Beech Forest	Up-to-Date ..	27	10 13	25.4	15	14	5	7	66.4	84	150.4
Sam Parker, Webster's Hill	Late Carman	24	11 8	27.1	12	14	7	8	68.1	81	149.1
J. Hobson, Laver's Hill	Sebago ..	31	9 0	21.4	10	15	6	5	57.4	80	137.4

* Entries of the Sequoia variety were non-competitive.

LIVE STOCK NOTES

Compiled by A. C. T. HEWITT, M.Agr.Sc.,
Live Stock Science Officer

THE "LET-DOWN" HORMONE IN DAIRY COWS

THE milk of the cow is let down by the contraction of muscles round the alveoli forcing the minute quantity of milk in each of the many million alveoli in the udder down the ducts into the milk cistern. It is only the milk in the milk cistern which can be drawn by the calf, hand milker, or milking machine, when the pressure of the milk inside the udder is high enough to force the milk through the sphincter muscle near the point of the teat.

The hand milker forces the milk out by imprisoning milk in the teat and applying pressure until the sphincter muscle yields and lets the milk out. The teat is released so that it can re-fill and then the milk is forced out again and so on. The calf and the milking machine draw the milk by suction. The sucking action of the calf and the pulsations of the milking machines massage the teats to keep an active circulation of blood running through them.

When Dr. W. E. Petersen, Professor of Dairy Husbandry, University of Minnesota, U.S.A., was in Victoria last December, he explained how the cow produced her milk and how it should be obtained from her.

The contraction of the muscles round the alveoli is caused by the hormone, oxytocin, when the cow relaxes for milking. The act of nursing the calf is the natural stimulus for the release of the let-down hormone and the cow should be trained to release the hormone at milking time as freely as she would when the calf would line up to suckle.

The training of the cow to release the hormone is one of the most important tasks in the milking shed. Cows which let their milk down freely can be milked quickly and will be the highest-producing and most profitable cows. Training the cow is mainly a matter of gaining her confidence and treating her kindly. The massage and washing of the udder with a cloth and warm water and the drawing of a jet from each teat assist the cow to involuntarily release the oxytocin.

Dr. Petersen has found that the hormone requires about 45 seconds to travel from the pituitary gland, where it is produced near

the brain, to the udder and cause the muscles to contract. The effects of the hormone last for only seven minutes, and milking must be commenced and completed while the stimulus is operating. The machines should be put on one minute after the stimulus is applied and removed as soon as the milk ceases to flow, but before removing the machines the teat cups should be held down with one hand and each quarter of the udder massaged downwards towards the teat with the other hand.

An important part of the training is to train the cow to let all her milk down to the machines and completely eliminate hand-stripping. Dr. Petersen emphasized the need to train the cows to milk out without hand-stripping. Handstripping frequently leads to incomplete let down to the machines as the cow involuntarily waits for a second stimulus when hand stripping commences.

The cow should not be disturbed or upset during milking. Upsets may stop the release of the hormone and prevent the let-down of milk. The cow is then said to hold up her milk.

If the teat cups are left on after milk flow ceases, the inner linings of the teat are apt to be rubbed together and be injured. Most mastitis occurs as the result of the causative organisms gaining entry to the tissues through injuries. [A.C.T.H.]

REDUCTION OF FARROWING LOSSES IN PIGS

In the May issue of this *Journal* figures were presented to show how money may be saved by raising bigger litters. Most sows lose one or more suckers in the first three weeks after farrowing and often these losses amount to 25 per cent. of the suckers born alive. Much of this wastage could be prevented if more care were taken with the breeding sows.

On many farms losses would be less serious if the sow were left in the paddock instead of being put into a pen with a concrete floor and low farrowing rail around the wall. The sow in a paddock, in preparation for farrowing, roots a hole in the ground in a sheltered position and lines it with odd pieces of grass for a nest. In the pen she probably has some straw, which she instinctively tries to arrange in the form of a nest. Concrete is much harder and generally colder than bare earth, and for these reasons farrowing results are often disappointing in concrete pens. The piglet has little chance of survival if a clumsy sow rolls or lies on it.

The concrete floor can be improved if a wooden platform is placed on it and the sow is confined to a narrow section by movable hurdles, in which she is unable to turn round. The wooden platform is warmer and, with an adequate amount of straw, the new-born pigs can get out of reach of the sow and burrow into the straw outside the hurdles.

There is now evidence that bigger litters can be reared by sloping the wooden platforms towards the back of the pen. Experience with sloping floors in farrowing pens has shown that losses can be reduced greatly by using a platform 5 ft. by 8 ft. with a slope of 8 inches to the back wall. At the foot of the slope at the back of the shed a "hover" is built, consisting of a braced horizontal board 1 ft. wide, 10 inches from the floor running along the back wall. The customary guard rails 10 inches from the floor are placed along the two sides. At the top of the slope, provision is made for a hurdle so that the sow can be kept on the sloping floor while farrowing. Limited quantities of straw are placed under the hover where the

Washing the teats and udder with warm water encourages the cow to let down her milk.

piglets will remain for most of the first weeks of their lives especially when the weather is cold, for the hover helps to stop losses due to exposure. The platform is made in three sections, each 2 ft. 8 in. wide, to facilitate cleaning of the pen for each farrowing.

[A. D. North, B.Agr.Sc., Science Field Officer.]

MELBOURNE SHEEP SHOW

The Melbourne Sheep Show will be held this year on Friday and Saturday, 29th and 30th July, in Dalgety and Company's wool store at Newmarket. Entries for the show close on Thursday, 23rd June. After the show, special stud sheep sales will be conducted on Monday and Tuesday, 1st and 2nd August. Sheep not entered in the show will be sold as usual on these days at the Commonwealth Wool and Produce Company's store at Macauley.

GREENFEED FOR POULTRY

Greenfeed is a natural and most desirable source of vitamin A and other accessory food factors. When fresh and succulent it has a beneficial effect on the health and egg production of poultry, but if coarse and fibrous it is of little value and may cause impaction of the crop and other digestive troubles.

Crops of oats, barley, maize, millet, and lucerne should be cut when approximately half grown and not when nearing maturity; they are then too fibrous for poultry. Greenfeed crops should be planted in succession at regular intervals rather than in large single areas at one time. Successive plantings are the most reliable means of obtaining regular supplies of suitable quality greenfeed.

Other crops—silver beet, lettuce, cabbage or cauliflower leaves, and rape can be fed at almost any stage of growth. Mixed grasses and clovers, if regularly mown and kept growing, can also be fed with advantage.

Greenfeed is fed mainly for its vitamin content and birds could not exist if fed solely on this class of foodstuff. The question arises, how much greenfeed they require? and should it be fed in excess of normal requirements? The egg is produced by the hen from the food consumed after all requirements for body maintenance have been met. The hen converts the raw food material into the finished product, the egg, and should be encouraged to eat as much food as possible to obtain maximum production. Greenfeed should be given with care, however as the addition of large quantities to wet mash, for example, packs the crop with bulky rather than rich food. When large quantities of fibrous greenfeed are added to the mash, digestive troubles usually develop and, although an additional amount of labour is entailed, it is better to provide mash without green-stuff for the morning feed and give the greenfeed at mid-day.

During recent years greenfeed has become almost an obsession with some poultry farmers and, while acknowledging its vital importance as a poultry food, too much indigestible greenstuff retards the consumption and digestion of sufficient nutrients.

If the quality of greenfeed conformed to a regular standard, specified quantities could be fed, but as quality varies considerably, vitamin deficiencies sometimes occur unless vitaminized oils are added to the mash.

Most authorities on poultry feeding maintain that 6 lb. of greenfeed per 100 birds per day is sufficient for normal requirements, but it must be succulent and it must be of good quality. Some poultry owners believe that, as fibrous greenfeed contains smaller quantities of vitamins than first quality greenstuff, additional quantities of the coarse material should be fed to supply sufficient vitamins. Fibre, however, is indigestible and harmful to poultry and, if better quality greens are not available, it may be better to eliminate the greenfeed entirely and use vitaminized oils. In the meantime consideration could be given to the cultivation of successive green crops for feeding in a young, succulent condition. Short, green pasture clippings provide one of the best green foods.

The following seed mixture is recommended to provide a pasture for regular mowing :—

	Parts by Weight
Perennial rye grass (Colac certified seed)	10
Cocksfoot	3
Alsike clover	1
Wild white clover ..	1
Subterranean clover (Mt. Barker strain)	3

Sow this mixture in autumn or early spring at the rate of 1 oz. of seed to five square yards, with 1 oz. of market garden manure to the square yard.

[M. D. Hall, Poultry Expert.]

TRICHOMONIASIS IN CATTLE

By A. Engel, B.V.Sc., Veterinary Officer

IT is now well established that a venereal disease, trichomoniasis, causing infertility and abortion in cattle is universally distributed. The name is derived from that of the causal organism, *Trichomonas foetus*, which is primarily associated with disease of the bovine genital organs. It is pear shaped, less than 1/1,500th inch long and moves very rapidly. It belongs to that group of life known as protozoa.

Sterility in cows associated with trichomonads was first reported from Italy in 1900, Germany in 1927, and England in 1937. In 1948, a few scattered reports indicated its presence in Australia.

Due to the insidious nature of its onset, trichomoniasis usually becomes firmly established in a herd before it is recognized. The organism appears in vaginal discharges at infrequent intervals, and, therefore, diagnosis under field conditions becomes very difficult. Similarity of history to other forms of infertility does not alleviate the position, as it becomes necessary to isolate the organism before a positive diagnosis can be made.

Diagnosis of this condition in bulls is equally difficult, as they rarely show symptoms and the organism can seldom be recovered from their genital organs.

SYMPTOMS

The Bull

Clinical evidence indicates that the bull is generally the source of infection, and is responsible for the spread of the disease during service.

When first infected, some bulls show symptoms of inflammation of the lining of the sheath, with a certain degree of discharge. This is accompanied by a period of "lazy service" due to existing painful conditions. Examination of the penis reveals reddened nodules which are "raspy" to the touch, and trichomonads can be found regularly in the lining folds of the sheath. These early inflammatory symptoms subside within a few days, and the bull then becomes a chronic "carrier". At this stage, trichomonads can rarely be recovered, the bull resumes his normal sexual activity and remains fertile. The animal, however, continues to infect cows mated with him. For this reason, having proved the disease present in a herd, the first step towards eradication should be to remove all contact bulls, as infection in these can be presumed.

Great care is taken by artificial insemination centres to ensure that selected bulls are free from trichomoniasis, because infected semen could cause considerable losses on dairy farms to which it is distributed.

The Cow

Suspicions that the disease has been introduced to a herd may be aroused when several cows return for service after having passed one or two heat periods, and been thought safely in calf. The majority of these cows actually "nick" successfully, but abort six to sixteen weeks after conception, and usually come on heat again three weeks later. The aborted foetus may be one to nine inches long, and is generally expelled in the intact after-birth. The discovery of a freshly-expelled foetus in the paddock or cowshed provides a reliable source of diagnosis as it contains numerous trichomonads.

Abortion typically occurs early in an outbreak, and when a cow, known to be clean, is mated wtih an infected bull, a temporary vaginitis (inflammation of the vagina) commonly follows in a few days. This is characterized by the presence of shot-like nodules in the vaginal wall, and passes off in four or five days.

Infection may then follow one of three courses; first, a chronic inflammation of the womb (endometritis) may develop; secondly, there may be conception followed by death and expulsion of the foetus; and thirdly, when the dead foetus is not expelled the womb becomes filled with pus (pyometra).

If endometritis supervenes, conception does not take place, and the cow will come on heat at three-weekly or irregular intervals, but continually fails to conceive. When abortion occurs, the normal sexual cycle is frequently resumed with subsequent conception. Such cows may or may not "slip" again.

When pyometra develops, the cow appears to "hold", but does not calve at the end of nine months, and frequently shows a continuous or intermittent discharge.

On cutting the womb from an infected animal after slaughter, it will be found to contain up to 9 gallons of a creamy to chocolate-coloured, odourless pus which teems with the trichomonad organism. Recovery chances are extremely remote once pyometra develops.

IMMUNITY

A spontaneous cure in some cows and resistance to the disease in others has presented the possibility that infected animals may become tolerant. Research workers have not been able to satisfactorily prove that immunity develops, but observations made on severely-infected herds indicate that infection does automatically decline after some months. Whether the infection becomes extinct or remains at a very low level has not been established.

DIAGNOSIS

Recognition of the organism *Trichomonas foetus* microscopically in discharges, smears, and aborted foetuses is the only satisfactory method of positively diagnosing this disease.

A close study of accurate service and breeding registers for bulls and cows will reveal cows returning for service, some regularly, others irregularly, and a few not at all. Cows with discharges and returning to the bull in two to four months are definite suspects.

Other sterility diseases however, have to be differentiated from trichomoniasis. In a herd affected with Contagious Abortion (Brucellosis) calves are generally slipped from five to eight months, occasionally earlier, and cows may remain sterile. Blood testing will confirm the presence or absence of brucellosis.

Sporadic (occasional) abortion occurs only in odd cows and is caused by various means, particularly injuries. Pyometra due to other organisms can be distinguished with the microscope. When a weak or sterile bull is used, the cows generally return at regular intervals.

TREATMENT AND CONTROL

No medicinal treatment efficient for recommendation has yet been found. A 1 in 400 solution of iodine (3½ to 5 fluid oz.) when injected directly into the womb has been of value according to experiments in Ireland. In England, propamidine, a complex organic drug, has been used with varying results. Treatment of the bull appears to be entirely unsatisfactory with the drugs that are available at present.

Present day methods undoubtedly indicate that control by husbandry and culling will eliminate the disease in a reasonable period of time.

It is stressed that owners should at all times keep a neat and accurate service and breeding record so that herd history can be fully investigated and diagnosis facilitated in the event of an outbreak.

The bull is regarded as a permanent "carrier" and this animal is the main source of infection. Therefore all infected bulls, or those used in infected herds should be destroyed. Replacement bulls should be bought as calves, otherwise they may already have had contact.

As has been previously stated, cows apparently become tolerant after a period of time, and accordingly any animal which has shown symptoms of early abortion should be rested from breeding for at least three months. Replacement cows if purchased should be bought as in-calf heifers and should only be mated with bulls which have not served suspect cows.

Where possible infected properties should be worked on a two-herd basis—one bull being retained for cows which were mated before the diagnosis was made and another bull, hitherto unused, for the remaining heifers. No cross-mating should be permitted between these herds. It is not necessary that the two herds be run separately, except that the bulls must be kept apart and in well constructed bull-yards. They should not be allowed to run with the herd under any circumstances.

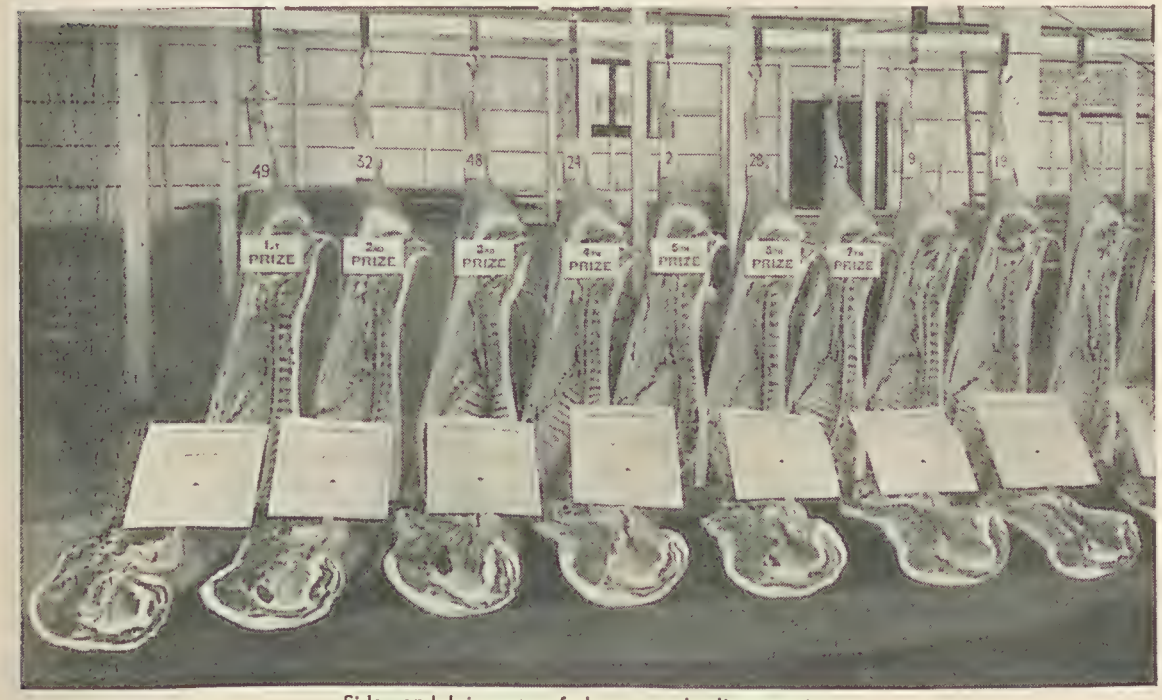
Regular examinations by a veterinary surgeon should be carried out to determine the presence of cows affected with pyometra. Such cows can be detected by feeling the womb when the arm is inserted in the rectum. Failure to calve, a chronic discharge, and the presence of a swollen but soft uterus are diagnostic symptoms.

Finally, precautions should be taken against the introduction of a neighbour's bull or cows, fences should be kept in good repair and gates kept shut.

Trichomoniasis is scheduled under the Stock Diseases Act and owners are obliged to report all suspected cases to the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

Bacon-Pig Carcass Competition

Report by L. A. Downey, H.D.A., Pig Expert, and A. D. North, B.Agr.Sc., Science Field Officer



Sides and loin cuts of the seven leading entries.

The second of the Australian Meat Board's Victorian Bacon Pig Competitions was held in Melbourne, during the first week in May, and provided much of interest and much information for those farmers who attended.

In view of the valuable knowledge which can be obtained from competitions and carcass appraisals it was disappointing that only 25 of the 10,000 or more Victorian pig breeders entered pigs in this competition. Conducted by the Australian Meat Board with the co-operation of the Victorian Department of Agriculture, the Royal Agricultural Society and the Australian Pig Society, the competitions are designed to give pig breeders the opportunity of viewing their products as their customers, the housewives see them; to check any defects and so improve the quality of their products.

The Australian Meat Board provided nearly £100 in cash and trophy prizes to foster the competitive spirit among pig breeders for the benefit of their industry.

The 49 entries were penned alive at the Melbourne Royal Showgrounds, where many of the exhibitors and others made a thorough examination of the live pigs and estimated their carcass quality. Next morning the pigs were slaughtered and dressed at the Footscray works of Messrs. Wm. Angliss and Co. The carcasses were appraised after chilling.

While the treatment and judging were taking place competitors and others were occupied and entertained at the Showgrounds. On Wednesday morning a small, but successful sale of stud pigs was held. In the afternoon judging demonstrations on live pigs were followed by a demonstration of carcass appraisal by Mr. Downey. A showing of films finalised the afternoon's proceedings.

On Thursday morning a convention convened by the Victorian branch of the Australian Pig Society discussed some of the problems of the industry. In the afternoon, Mr. J. T. Reynolds, Commonwealth Veterinary Officer, gave a talk on aspects of meat inspection which he illustrated with pig

carcasses and specimens. On Friday morning the results of the competition were announced and all of the 49 carcasses were displayed at the Showgrounds.

As in previous competitions, the English method of appraisal was used in judging the carcasses. Details of this method may be obtained from the Department of Agriculture. To qualify in this competition the dressed carcass had to weigh at least 120 lb. and not more than 180 lb. Because of this condition six entries were disqualified because they were not heavy enough. The 43 entries which complied with the conditions of entry had an average score of 63·3 per cent. The average for each section of judging is given below :—

TABLE 1.

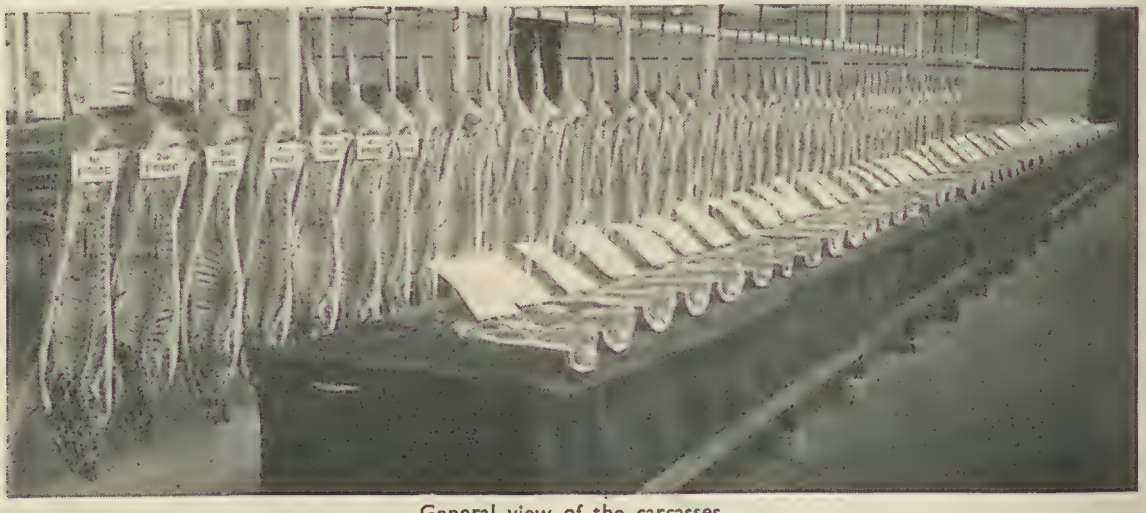
—	Possible Points.	Average Points. Obtained	Percentage of Possible Points.
By Inspection—			
Ham	8	5·3	65·7
Shoulder	7	4·7	67·3
Streak	12	5·7	47·7
By Measurement			
Muscle at loin ..	28	16·4	58·6
Thickness of back fat	20	13·4	66·7
Length of body ..	20	15·5	77·7
Length of leg ..	5	2·3	45·6
Total ..	100	63·3	

Following presentation of prizes by the Minister of Agriculture, the Hon. A. H. Dennett, M.L.A., Mr. G. C. Griffiths, the judge, remarked upon the lack of fat in many of the streaks. This observation was supported by an analysis of the back-fat measurements which showed that 22 carcasses were not carrying sufficient fat to obtain the maximum for this section, while 15 were overfat to varying degress and six had the optimum.

First and third prizes went to Mr. R. J. Chisholm of Archie's Creek. Mr. Chisholm was competing for the first time in a pig carcass competition. His pig carcasses weighed 167 lb. and 165 lb. each. This competitor does not restrict the food his pigs consume and this pair had grown very fast with an abundance of lean meat without excessive fat.

After receiving his prizes Mr. Chisholm told the audience how he produced his winning pigs, which were from two litters of pure Large Whites. They were born in small movable huts in ¼-acre paddocks. The sows and suckers had continuous access to self-feeders full of crushed wheat, and buttermilk was provided in other troughs most of the time. There was rye grass and clover pasture in the paddocks.

The sows were removed from the paddocks about eight weeks after farrowing and the weaners remained for another month. They were then placed in intensive pens with concrete floors, "wormed" and left there till taken away to slaughter, their food being as much buttermilk as they could drink and crushed wheat from a self-feeder.



General view of the carcasses.

The second prize-winner was an entry from Messrs. F. W. and O. M. Hawtin, Bena. This Large White - Tamworth cross - bred carcass was good in all respects.

Fourth prize went to Messrs T. M. Noble and Sons' Large White. Messrs Fairchild and Clutterbuck's Large White and Mr. W. A. Roy's Berkshire were equal fifth. The remaining prize was won by Mr. L. H. Castle's Large White entry.

In Table 2 a list is given of all entries which qualified for certificates of merit awarded for a score of 65 per cent. or more. Twenty-four entries qualified for this distinction. It takes a good carcass to score 65 per cent. and the pig industry in general would benefit if more pig raisers would make the effort to find out what is wrong with their pigs. The lessons learned would enable them to rectify faults in feeding and breeding and to produce a better quality product.

BACON-PIG CARCASS COMPETITION

TABLE 2.—PARTICULARS OF THE ENTRIES WHICH GAINED CERTIFICATES OF MERIT

Place in Competition Awards.	Entry Number.	Name and Address of Exhibitor.	Breed of Pig.	Date of Birth.	Weight of Carcass in lbs.	Points Gained from Possible 100.
1	49	R. J. Chisholm, Archie's Creek	Large White ..	15.11.48	167	84½
2	32	F. W. and O. M. Hawtin, Bena	Large White x Tamworth	10.10.48	146	81½
3	48	R. J. Chisholm, Archie's Creek	Large White ..	1.11.48	165	77½
4	24	T. M. Noble and Sons, Maffra	Large White ..	15.11.48	169	76½
= 5	28	Fairchild and Clutterbuck, "Vaucluse," Tinamba	Large White ..	20.10.48	173	74
= 5	2	W. A. Roy, Morrel's Hill, Boolarra ..	Berkshire ..	13.10.48	158	74
7	25	L. H. Castle, Bass Valley-road, Bena ..	Large White ..	15.10.48	134	73½
8	9	I. E. and F. Hawtin, "Rossmoyne," Colac West	Large White ..	9.9.48	147	72½
9	19	A. W. and S. Williams, "Hill View," Weerite	Berkshire ..	27.9.48	174	72
=10	8	P. W. Clark and Son, "Coodardy," Whittlesea	Berkshire ..	22.10.48	170	71
=10	50	G. and W. Foster Bros., Foster-road, Notting Hill	Large White ..	20.10.48	159	71
12	3	W. Cockbill, "Fulham Park," Rockbank ..	Large White ..	22.10.48	152	70½
=13	10	I. E and F. Hawtin, "Rossmoyne," Colac West	Large White ..	9.9.48	158	69
=13	27	Fairchild and Clutterbuck, "Vaucluse," Tinamba	Large White ..	20.10.48	176	69
=15	21	B. Whelpton, Whittlesea	Berkshire ..	15.9.48	148	67
=15	23	T. M. Noble and Sons, Maffra	Large White ..	15.11.48	178	67
=15	30	Mental Hospital, Mont Park	Large White ..	5.11.48	149	67
=15	31	F. W. and O. M. Hawtin, Bena	Large White x Tamworth	10.10.48	149	67
=19	20	A. W. and S. Williams, "Hill View," Weerite	Berkshire ..	27.9.48	180	66
=19	26	L. H. Castle, Bass Valley-road, Bena ..	Large White ..	30.10.48	160	66
=19	35	J. P. Austin, "Beacon Hill," Boolarra ..	Berkshire ..	10.12.48	142	66
=22	14	S. R. Thompson, Corio	Large White ..	22.11.48	173	65½
=22	36	J. P. Austin, "Beacon Hill," Boolarra ..	Berkshire ..	10.12.48	150	65½
24	22	B. Whelpton, Whittlesea	Berkshire ..	20.10.48	134	65

CODLING MOTH AND LIGHT-BROWN APPLE MOTH

Experiments in Goulburn Valley

By T. W. Hogan, M.Agr.Sc., Senior Entomologist and D. S. Morris, B.Agr.Sc., Assistant Entomologist, Biological Branch

Coincident with the general adoption of DDT for codling moth control in the Goulburn Valley there has been a considerable increase in the damage caused by the native insect, the Light-brown Apple Moth (*Tortrix postvittana* Walk.). The 1948-49 trials on Williams' bon Chretien pears in the Goulburn Valley, therefore, included treatments against this insect in addition to Codling Moth.

THE treatments set out in Table 1 for codling moth control comprised three strengths of DDT,* two versus three sprays, and a comparison between a standard nozzle, and a new nozzle designed to give a lower, but uniformly distributed, dosage to each tree.

In view of the unsatisfactory control of apple moth with DDT, a series of treatments containing lead arsenate at the rate of 3 lb. of powder to 100 gallons, mixed with each strength of DDT was included, and applied with the same difference in volume and number of sprays as used for codling moth.

The experimental block was given a factorial lay-out with twelve trees to each plot and eight replicates to each treatment except the overlying treatments viz., number of sprays and types of nozzle, of which there were four replicates. To permit the completion of the spraying of the plots in one day and to cover a wider range of conditions, the experimental block was divided into duplicate halves on different properties. One of these had had DDT applied to the trees for the first time the previous season and the other for the previous two seasons.

Supplementary plots (described later) were established for testing a Buffalo turbine spray machine and the new insecticide E-605 (*di-ethyl para nitrophenyl thiophosphate*).

* A dispersible powder containing 50 per cent. p.p.i. DDT.

RESULTS

Table 1. shows the infestation for codling moth and light-brown apple moth for all treatments. Codling moth infestation was at a very low level throughout the plots and no significant difference was obtained between the various treatments. The major point of interest for this insect pest is that two sprays of 0·05 per cent. DDT applied at a volume 40 per cent lower than standard spraying and with a saving in time of application of 15 per cent. gave only 0·2 per cent. infestation of codling moth.

For apple moth, the addition of lead arsenate at the rate of 3 lb. to 100 gallons gave effective control. DDT alone was unsatisfactory, giving an average of 11 per cent. infestation compared with an average of 0·5 per cent. for those treatments containing lead arsenate.

A third spray containing lead arsenate did not cause any significant improvement over the two-spray schedule. Similarly to codling moth, decrease in the volume of spray applied, by an average quantity of 1½ gallons per tree, did not cause any rise in level of infestation.

Bryobia mite infestation in both sets of plots remained at an extremely low level throughout the season, and red spider infestation did not occur.

DDT residues at harvest time, on fruit given three sprays of 0·1 per cent. DDT, did not exceed one part per million (statutory limit is 9 parts per million).

DISCUSSION

Codling Moth

Codling moth infestation was so much lower than for previous seasons, in which heavier applications of DDT were given, that it suggests that the season was generally unfavourable for codling moth development. On the other hand, the entirely new set of conditions produced by the application of DDT over the past few seasons makes it possible that the low infestation was simply a cumulative effect from successive seasons' spraying with DDT.

Fig. 1 (upper picture)—Conical spray from standard nozzles used in the experiment.
Fig. 2 (right)—Flat, wide spray from special nozzles used.

Light-brown Apple Moth

There has been a tendency to attribute the sudden rise in apple moth damage to seasonal conditions, but conclusive evidence is provided in this year's experiments that DDT, at the low level required for codling moth, is not an effective control measure against apple moth.

It seems likely that the apple moth is less sensitive to DDT than codling moth, but even if this were not so, a consideration of the factors involved shows good reasons why an increase in the former should be expected when DDT alone is used.

The most important of these is the relative specificity of codling moth to apples and pears, compared with the wide host range, (including many weeds), of the apple moth. With a lead-arsenate programme this difference is unimportant as a constant cover of insecticide is kept on the fruit.

The fact that DDT becomes ineffective after several weeks' exposure on the tree and that fewer and more widely-spaced sprays are used, means that the fruit is left unprotected for long periods during the season. As codling moth is a brood insect and each brood is controlled in its early stages by DDT, constant coverage of the fruit with this insecticide is not required, but apple moth from weeds and other hosts is able to attack the fruit during the periods it is left unprotected.

From this season's experiment it would appear that protection against apple moth is not required late in the season. The critical period may vary from one season to the next, however, and the timing of the spray may involve a study of the bionomics of the insect. The first damage to fruit by apple moth was observed on November 12th.

The common dock weed was noticed to be an important host plant of the apple moth and invariably the dock under the DDT treatments of the experimental block carried numerous apple moth larvae whereas the lead arsenate plots were clean. The lead arsenate which the weeds received incidental to the spraying of the trees was, therefore, sufficient to control the infestation on them.

TABLE 1.—SHOWING CODLING MOTH AND LIGHT-BROWN APPLE MOTH DAMAGE TO W.B.C. PEARS ON EXPERIMENTAL PLOTS AT SHEPPARTON EAST 1948–49.

Treatment No.	Treatment.	Total Fruit.	Percentage Light Brown Apple Moth Infestation.			Percentage Codling Moth Infestation.		
			Two Sprays.	Three Sprays.	Total for Treatment.	Two Sprays.	Three Sprays.	Total for Treatment.
1 ..	0·05 per cent. DDT	13,864	13·4	9·9	11·5	0·2	0·03	0·09
2 ..	0·075 per cent. DDT ..	12,250	15·7	10·4	13·2	0·05	0·01	0·08
3 ..	0·1 per cent DDT	13,479	9·3	12·0	10·7	0·15	0·15	0·15
4 ..	0·05 per cent. DDT + 3 lb. lead arsenate/100 gallons ..	13,427	0·5	0·2	0·4	0·16	0·1	0·12
5 ..	0·075 per cent. DDT + 3 lb. lead arsenate/100 gallons ..	12,115	0·8	0·3	0·5	0·04	0·01	0·02
6 ..	0·1 per cent. DDT + 3 lb. lead arsenate/100 gallons ..	13,336	0·5	0·6	0·5	0·03	0·0	0·01

It would appear, from observation in the district, that clean cultivation of the orchard should be a factor in keeping down the apple moth population.

Volume of Spray

The advent of DDT has accelerated the trend towards a reduction in the volume of spray applied, compensated for by an increase in concentration of the spray. The development of "blower" types of machine (see later) is an aspect of this trend, but such machines are not satisfactory for all spraying needs, Victorian growers, at present, are not prepared to purchase both types of machinery and are retaining the standard spray pumps.

In these plots, a test was included to determine the efficiency of reduced volumes of spray applied by such standard spray pumps. The reduced volume was obtained by means of special nozzles spaced 8 inches apart at the end of each rod (Fig. 2) giving fan-shaped jets, and having a lower rate of output than the standard nozzle. The "standard" rate of application was obtained by permitting the spray teams to proceed at their normal rate, a check being made, however, to ensure that all parts of each tree were sprayed.

Conclusion

Two sprays applied early in the season containing 0·05 per cent. DDT and 3 lb. of lead arsenate per 100 gallons, appears to be highly satisfactory to combat light-brown apple moth and codling moth in W.B.C. pears in the Goulburn Valley.

PILOT PLOTS

E-605 (di-ethyl para nitro phenyl thiophosphate)*

Randomised two-tree plots were sprayed twice with four replicates of two treatments viz., E-605 at 0·05 per cent. and DDT 0·1 per cent. plus 0·3 per cent. lead arsenate. Four trees on the edge of the plot were left unsprayed. The results are shown in Table 2.

* Supplied by Henry York, and Co., Melbourne.

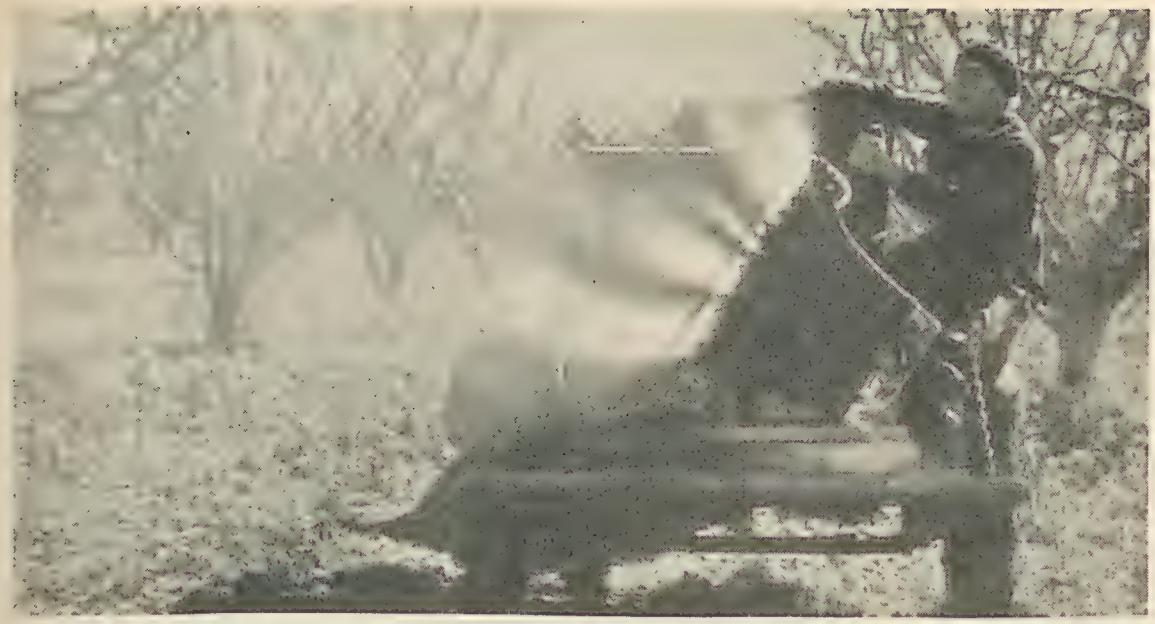


Fig. 3—Buffalo turbine sprayer.

TABLE 2.—INFESTATION OF CODLING MOTH AND LIGHT-BROWN APPLE MOTH IN PLOTS SPRAYED WITH E–605.

—	E–605.	DDT—Lead Arsenate.	Control.
	%	%	%
Codling Moth ..	2.3	0.2	23.4
Light-brown Apple Moth	4.1	0.3	11.9

The two sprays were applied on October 19th and November 26th. E–605 residue on fruit analysed after picking was less than one part per million.

COMMENT

E–605 having given satisfactory control of both codling moth and apple moth, and having been proved as an excellent miticide in earlier tests, shows promise as a general purpose spray for pears in the Goulburn Valley.

Buffalo Turbine Orchard Sprayer

The turbine orchard sprayer can operate either as a sprayer or duster, but was tested only as a sprayer. The spraying device consists of a turbine blower generating an air blast which leaves the outlet of the machine at about 120–140 m.p.h., atomising the spray injected into the blast from a series of jets and acting as the carrier for the spray droplets into the tree. By using this principle a concentrated spray at a volume of only 14 to 20 gallons per acre can be applied. Output of spray from this machine is about 1½ gallons per minute.

Power is supplied by an 18 h.p. air cooled petrol engine and the unit was transported on a sled pulled by a tractor.

PLOT LAY-OUT

As it was impracticable to use small plots, three sections of an orchard each of 36 trees in four rows were treated, the remainder of the orchard being sprayed with an ordinary spray pump. Four trees from the centre two rows of each plot were sampled at the end of the season.

TABLE 3.—CODLING MOTH AND LIGHT-BROWN APPLE MOTH INFESTATION OF TURBINE-SPRAYED PLOTS.

Treatment.	Codling Moth.	Apple Moth.
	%	%
Control plots	0.04	0.38
"Turbine" plots ..	0.12	7.44

Two sprays were applied for the season, the first spray being 0·5 per cent. DDT alone and the second a mixture of 0·5

per cent DDT and lead arsenate 1·2 per cent. (12 lb./100 gals.). The controls received three sprays of a mixed spray of 0·1 per cent. DDT and 0·3 per cent. lead arsenate.

COMMENT

Further tests will be necessary to determine whether this machine is suitable for apple moth control.

The coverage given by this sprayer is not complete and therefore limits the purposes for which it can be used.

Summary

Results are given of the 1948–49 trials for the control of codling moth and light-brown apple moth of Williams' bon Chretien pears in the Goulburn Valley.

Codling moth infestation was at an extremely low level in all plots and no significant differences were obtained between the treatments in the main series of plots. In this experiment two sprays of 0·05 per cent. DDT applied at 60 per cent. of the normal volume gave an average infestation of only 0·2 per cent.

Against the apple moth two sprays of a mixture of DDT and lead arsenate reduced the infestation from 11·8 per cent. to 0·5 per cent. A third spray later in the season gave no improvement in control.

A reduction of 40 per cent. in the volume of spray applied to the trees by means of a specially designed nozzle did not affect the degree of control for either insect, while at the same time reducing the cost of spraying.

Under the conditions of this experiment no significant mite infestation occurred in any of the plots.

In supplementary tests the Buffalo turbine spray machine gave satisfactory control of codling moth, but further tests are necessary to determine whether it can control apple moth effectively.

E-605 gave satisfactory control of both codling moth and apple moth.

ACKNOWLEDGMENTS

The authors acknowledge the co-operation of Messrs. Newman, Pearce and Roberts, on whose properties the trials were conducted, and the assistance of Mr. Bullock, Orchard Supervisor at Shepparton, on the plots. Analyses of DDT and E-605 residues were carried out by the staff of the Chief Chemist.

Black Spot of the Udder

Black spot is an infectious condition, occurring on the teats of cows, frequently around the orifice. From here, it may spread over the udder and sometimes over the under surface of the abdomen. It usually infects the cow before calving, and when milk secretion commences, a dark-colored scab appears which often blocks the teat opening.

The teats are painful to handle, and as the scab may have to be removed before each milking, the raw surface is likely to become infected with other organisms and the infected area entend up the teat canal, possibly causing mastitis. Unless care is exercised, the disease may spread from cow to cow, rendering many useless for milking. In any case, milk from such cows is unfit for human consumption.

Where the udder and abdomen are affected, there may be serious generalized reactions, and portions of infected skin may swell and slough. To prevent this condition developing the teats should be immersed daily in a solution of sodium hypochlorite (two tablespoonsful to four gallons of water) for a fortnight before calving. When ulcers appear, foment with a hot solution of permanganate of potash, gently remove some of the scabs, thoroughly dry the parts and apply to the affected surface acriflavine or monacrin ointment, either of which may be obtained from a chemist.

Alternative treatments are :—

Salicylic acid 1 part and lanoline or lard 10 parts ;

Or powdered bluestone 1 part in 9 parts of petroleum jelly.

[H. TUCKER, B.V.Sc., Veterinary Officer.]

ORCHARD NOTES

Winter Sprays • Green Peach Aphis • Clearing Land for Fruit Trees • Zinc Deficiency in Deciduous Trees

By G. W. Gayford, B.Agr.Sc., Senior Horticultural Instructor

WINTER SPRAYS

BRYOBIA mite has been a serious pest in Victorian apple and pear orchards during the past season. The bronzed unhealthy appearance of many apple and pear trees towards the end of the summer was due to the presence on the trees of millions of these mites. The widespread use of DDT seems to have favoured the increased activity of mites and red spider. Fortunately the new insecticides HETP and E605 show promise of reducing damage by these pests in the summer. However, summer control is not yet entirely satisfactory and is still under investigation.

On many properties in late summer apple trees were almost defoliated. A pest in such large numbers obviously must have some effect in the bearing capacity of a tree and consequently every endeavour should be made to keep the mite under control. Thorough winter spraying is the best means of ensuring this.

An examination of several orchards recently indicated that mite eggs are present in large numbers. These were seen clustered at the base of twigs and spurs on both apple and pear trees. The eggs are pinkish in colour and are the chief means whereby the mites carry over the winter into the next season, hatching out from September onwards.

The eggs may be killed by winter-strength sprays of lime-sulphur or dormant spraying oil. Either lime sulphur 1 in 10 or dormant spraying oil 1 in 14 may be used. Special oils also are available, and these may be applied safely during the dormant period in combination with lime-sulphur. Such a spray would consist of 3 gallons of oil plus 5 gallons lime sulphur in 80 gallons of water. These sprays may be applied as near as possible to bud burst.

If unfavourable weather prevents the application of dormant sprays, one of the semi-dormant oils, which can be combined safely with lime-sulphur and Bordeaux mixture, may be used in one of the black spot sprays before the "pink" stage.

Applying a winter spray to destroy the eggs of Bryobia mite.

GREEN PEACH APHIS

The green peach aphis caused considerable damage in the Goulburn Valley last spring, and much time was lost applying expensive sprays against the adult insect.

This insect can be dealt with very effectively during the winter by the use of sprays of tar distillate 1 to 35, or DNC 1 to 40. Spraying should be completed by mid-July. These sprays kill the eggs and, if thoroughly applied, will prevent trouble later in the season. The rate of breeding of these insects once they hatch out is rapid and a few eggs left on the tip of a leader

missed by the spray will multiply into millions in the space of a few weeks if the weather is favourable.

Thoroughness and the choice of fine calm days for winter spraying are essential to success.

SAN JOSE SCALE

San Jose Scale may cause serious trouble in deciduous orchards if not controlled. The scales are small and circular and when present in large numbers, give limbs and twigs a scurfy appearance. Ordinary winter strength oil or lime-sulphur sprays are satisfactory for mild attacks, but in a severe infestation the best spray consists of winter white-oil 2 gallons and lime-sulphur $5\frac{1}{2}$ gallons in $72\frac{1}{2}$ gallons water.

CLEARING LAND FOR FRUIT TREES

Where orchards are planted on land cleared of native timber just prior to setting out the fruit trees, there is a possibility that the roots of these trees may be attacked by the fungous disease *Armillaria mellea*. If trees become unhealthy and show signs of die-back or even die out completely, they may be infected with this disease. The disease is recognized by the black strands which surround the roots and also by a whitish substance between the bark and the wood of the root.

The trouble once established, is difficult to control. If not too far advanced, the soil around the base of the tree and larger roots should be removed and a solution of sulphate of iron 1 lb. to 5 gallons water poured into the depression. Fifteen to twenty gallons of this solution are used, and an additional 3 to 4 lb. of sulphate of iron crystals are applied around the tree on the undisturbed portion of the soil. The base of the tree and the larger roots should then be left exposed to the atmosphere.

In clearing new land for orchards, watch carefully for signs of the black armillaria strands on roots of native timber. Honey-coloured toadstools at the foot of infected trees produce spores and these may also transmit the disease from one tree to another. Native trees should be ring-barked and poisoned in the autum so that the trees die slowly before removal. The food material stored in the roots is then used up as the tree slowly dies and this means that the fungus cannot exist on the old roots. However, where possible the old root system should be removed and burnt.

At present much of the clearing of new land is being done by bulldozers, and in such cases the removal of roots is not carried out as thoroughly as with the older, slower methods. If armillaria is detected the land should be sown in grasses or vegetables for several years before it is set out with fruit trees.

The bulldozer is a rapid, surface-clearing machine, but does not remove all the roots. If *Armillaria* is noticed on new land, fruit trees should not be planted until it is eliminated.

ZINC DEFICIENCY IN DECIDUOUS TREES

Zinc deficiency is another cause of ill-health in fruit trees. This is becoming more noticeable in some of the apple, pear, and stone-fruit growing areas around Horsham and in the Goulburn Valley and Mildura districts. Affected trees have small narrow leaves which, at the tips of branches, are in typical rosettes with short internodes. Leaves fall progressively from the base to the tip of twigs which may eventually die from the tip downwards. In stone fruits a marked yellowing between the veins is noticeable.

The condition may be remedied by spraying in the winter with zinc sulphate at the rate of 50 lb. to 100 gallons of water. The spray should be applied either before pruning or two to three weeks after pruning to allow the freshly cut surfaces to callus over and so avoid the possibility of damage.

Garden Notes for June–July

By George Hyam, Horticultural Supervisor

As from July the garden notes will be published one month in advance of the month of issue to enable readers to be prepared for the seasonal work suggested. The notes for August will appear in the July issue; those for September in the August issue, and so on.

THE FLOWER GARDEN

Planting out Roses

Although roses can be planted until early August, June planting is preferred, as the bushes can make considerable root growth during the winter months. Consequently, if planted early, they will make better top growth in the following spring. The beds should be prepared well in advance of planting to allow the soil to settle, even if planting has to be delayed. Beds should be dug deeply or trenched, and be well drained. In dry districts, or in dry weather, the planting sites should be given a good soaking a week before planting.

Stakes are essential for standard roses. These should be substantial, and preferably of jarrah or red gum, 4 feet long by 1½ inches by 1½ inches. Place the stake in the ground before planting at a depth not less than 2 inches below the head of the plant. If allowed to protrude through the head, the stake can damage limbs by chafing and will interfere with the proper shaping of the bush. The stake should be placed approximately 1½ inches away from the rose plant, and is best inserted on the north-west side of it.

Country gardeners receiving roses from distant nurseries should unpack them immediately on arrival, and, if planting has to be delayed, the plants should be temporarily heeled into a trench with their roots covered in soil packed around them, and watered. If, owing to delays in transit, the bark is shrivelled, the whole plants should be laid horizontally along the bottom of a trench, covered with loose soil, and watered. Within a week or so, unless they have completely dried out, they should have recovered and can then be planted.

Planting depth is important. Standards are planted at the same depth, as they were in the nursery row. This depth is plainly indicated by the soil mark. For the time being, they should not be tied to the stake as the soil may sink a little during the first month or so, and, if the plants are tied, they might be left suspended with an air-pocket under their roots. Many gardeners make the mistake of not planting dwarf bush and climbing roses deep enough. These are budded above-ground for convenience, but these roses should be planted so that the lowest bud or two of head is under the surface of the ground. First cut off any portion of the stock which projects beyond the bud, in a slanting direction, as close as possible to the bud, but not so close as to disturb it. This allows the head to callus over the cut and to grow in a symmetrical erect position.

Pruning newly-planted roses. The arrows point to the grafts. A, C, roses as received from the nursery. B, D, roses as pruned after planting. The dotted lines indicate the correct planting depth.

Deep planting encourages more base growth and adds to the vigour of the plant. No manure or fertiliser should be applied when planting, even if the ground has not been previously manured, and no rose should be planted in a pot-hole with rubbish underneath. Later, the plants can be fed by top-dressing. After filling in the soil, trample it well round the roots and soak with water.

Another common mistake is failure to cut back the heads of roses after planting. As sent from the nursery, although usually cut back a little, the heads are left fairly long to protect the plants while in transit. The shoots of standard roses should be shortened back to about three or four buds from the union and left with one, two, or three good stems only.

Dwarf and climbing roses are limited to about one or two main shoots which are shortened back to about four buds, or left a little longer if they are particularly robust.

Many young roses fail to become established by not being watered during a winter of light or scanty rainfall. At all times, the soil should be kept moist, taking care that the lower soil is damp and not merely the surface layers. As their root area is restricted, young roses will suffer from somewhat dry conditions, which would not seriously affect an established rose.

Winter Treatment of Established Roses

June and July is pruning time for roses. There is some difference of opinion as to what period in these months is best for pruning, but the condition of the buds is probably the best guide.

When the dormant buds formed at the back of last season's foliage show signs of swelling and turn pink, pruning should begin. In Melbourne, and districts with similar climatic conditions, early to mid-June is a good time to prune the hybrid perpetual varieties and the middle of July for the later-flowering hybrid tea and tea roses, though weather conditions may vary this somewhat. In cool hill districts, where late frosts can be expected, the end of July is soon enough for all species.

For garden display, a greater spread of the spring flowering can often be obtained by spreading the pruning over, say, six weeks, cutting back about one-third of a rose at intervals of a fortnight. In any case, some annual pruning is essential, as the rose only flowers on new growth produced during the same season. Thus, new growth must be encouraged if plenty of flowers are to be produced. The work is not difficult. In the main, it consists of first cutting out all weak and exhausted wood; shortening back robust growth to an outside bud, and keeping the centre reasonably open.

Those vigorous growths known as water-shoots which spring at or near the base should always be retained. They terminate in three flowering shoots and two of these should be removed and the third shortened back a little. They are valuable as they will form new main branches and often replace an exhausted leader, thus regenerating the plant. They should never be cut hard back.

After pruning, the plants will benefit by spraying with red or white oil to help to keep down aphis and scale. Mildew was prevalent last season as a result of humid weather, and plants that were affected will benefit by a winter application of Bordeaux. This can be mixed with the oil, or, if sprayed separately, apply the Bordeaux first.

Take the opportunity of removing any sucker growth while the plants are dormant. This is most effectively done by scraping the soil away until the root from which they spring is uncovered, and then severing with the secateurs at that point. Lightly fork the soil round the rose plants and leave the surface in the rough until August.

Other June and July Work

All deciduous ornamental trees are best planted during these months, but evergreens should be left until the soil temperature starts to rise in spring. Any established deciduous ornamentals will benefit by an oil spray at this time when they are dormant, and any pruning or lopping of the foliage kinds should be carried out during June and July.

The flowering fruit trees are best pruned immediately after flowering. Conifers are sometimes affected with scale, and a winter oil spray will check this. The flowering of winter annuals will be prolonged well into spring if the flowers are not allowed to set seed. Do not try to force these during cold weather by dressings of fertiliser. They can be stimulated later as the weather starts to get warmer.

Late Onions for Storage

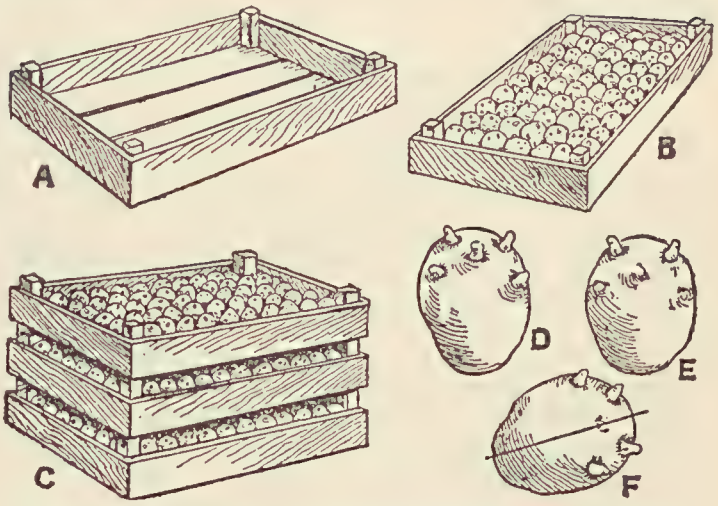
The main onion crop to produce long-keeping onions for storage can be sown in all districts throughout June, and July. The Australian Brown onion, often misnamed Brown Spanish, has a world-wide reputation for its keeping qualities, and is the basis of a sound onion-growing industry in this State.

While the length of its storing season is to some extent influenced by soil and climatic conditions, this variety can be grown under garden conditions in all parts of the State. The Australian Brown seems to do best when sown direct in the beds rather than when raised in seed beds for transplanting as is done with the early varieties. However, this latter method can be used with little detriment where beds are at present occupied.

This Department has a certified onion seed scheme for this variety which helps considerably to standardise the size, shape and quality of the bulbs. Home gardeners therefore would be well advised to obtain seed certified under this scheme.

In the onion-growing districts it is not customary to use fertilizers, but in the average home garden about 1-oz. to the sq.-yd. of 5-1-1, superphosphate, ammonia and potash applied before sowing is recommended for use on light soils, or the same quantity of blood and bone on heavier types, if the soil was not well manured for a previous crop. Sow in drills spaced 12 inches apart as thinly as possible, afterwards thinning to about 5 inches between the plants. On highly acid soils, it is advisable to apply lime a few weeks before planting, and heavy clay soils should be lightened by digging in rotted stable manure or compost instead of applying fertilizer.

In cold, wet districts, sowing is better deferred until late July or plant the beds with seedlings during August or September, otherwise the plants may suffer from mildew. In all districts, the mid-season Brown Globe onion seedlings can still be planted out during these months.



Potato sets should be "greened" before planting. A, B, C—Greening trays. D, E—Sets over 2 inches in diameter should be cut as shown, F.

Early Potatoes

In all but late districts, and particularly on light soils, Carman No. 1 potatoes can be planted out early in July. It is advisable to use certified seed sets and to green and sprout them before planting. Main plantings of potatoes in small gardens may not be justified because of the space they occupy but this early planting can be lifted as new potatoes in November in good time to replant the bed with some summer vegetable.

Dig over the plot a week or two before planting, working in some organic manure if this has not been recently applied. Take out furrows 4 to 5 inches deep and along the edges, dust 5-1-1 fertilizer at the rate of about ½ lb. per 10 ft. Place the sets at the bottom of the furrow so that they do not contact the fertilizer, spacing them 14 to 15 inches apart, with the rows 2 ft. apart. See that there is at least 4 inches of soil above the set after filling in.

Sets 2 inches in diameter, or less are planted whole; larger tubers are best cut so that each piece has one or two good eyes. Avoid planting potatoes immediately after tomato crops and vice versa as potatoes are subject to some diseases common to both. No lime should be applied before planting.

Potatoes are a good crop to plant on new areas just being converted to gardens as they help clean up weeds and condition the

soil for other crops. In older gardens, they do best when following legume crops such as peas or beans.

Plant Perennial Vegetables in Winter

Any new plantings of asparagus or rhubarb should be made during June and July. Both do best in soil which has been heavily enriched with stable or other animal manure, but this should be dug in deeply where it will not contact the roots of the new plant.

As asparagus is productive in the same bed for 15 to 20 years or even longer if well tended, opportunity has to be taken at planting time to enrich the soil. A 10-inch layer of stable manure distributed through the lower soil would not be too much. If this is not available liberal quantities of blood and bone manure could be used. Drainage must be good and in heavy soils, it is best to cover the plants with light soil brought in from elsewhere.

Rhubarb can also do with ample quantities of manure but as the roots are lifted and divided every fifth year or so, the amount dug in at planting time can be somewhat less than for asparagus, particularly as the roots can, and should be, mulched with manure every spring. Both these vegetables should be grown in the open. Asparagus will give only a light crop if grown in shade, and rhubarb is subject to mildew in shady places.

The winter months are best for dividing herb plants. After the third or fourth year, culinary herbs such as sage, thyme and marjoram tend to become woody at the expense of leafage. They can be divided with a sharp knife into portions with roots attached. For re-planting it is better to use the outside pieces and to reject the older centre portions. Herbs are best planted in a soil not over-rich, as such soil tends to lessen their essential oil content which provides their flavour.

Only in the poorest soils are fertilizers needed and then a slow acting manure like blood and bone is best. All herbs like a light mulch around them in summer as their roots should be kept cool and moist. This is usually quite sufficient feeding for them in average garden soils, but mint is the exception. It responds to organic manure dug in when planting or as a winter top-dressing. Better leaves are obtained if it is lifted and replanted every winter. Winter supplies of mint can be provided by planting some in a kerosene tin or box and keeping this under a frame or out of the frost on a sunny verandah. Clumps of chives should be cut down to 2 inches from the ground and lifted, divided and re-planted every winter.

Routine Winter Work

Apart from these vegetables mentioned above, there is little to plant during these months except peas and the final sowing of broad beans, both of which will mature in time to be replaced with summer crops.

There is little or no activity by the cabbage grubs during these months but occasional warm spells can cause them to become active. Therefore while routine dustings may be lessened, they should be applied if any grub damage is noticed. On the other hand cabbage aphis appears very quickly and often during the winter. At the first sign it should be controlled by dusting with nicotine or HETP sprays or dusts containing nicotine or Gammexane.

The black bean aphis may appear on early-sown crops of broad beans and the same treatment will control these. A careful watch should be kept for bean rust—reddish pustules on leaves, or any form of leaf spot. These can be checked if promptly sprayed with Bordeaux mixture.

Lettuce for early spring use can be sown in warm well-drained seeds beds in July, using either Imperial 615 or New York for this sowing. These will transplant well and are not so likely to suffer damage from wet and cold conditions as if sown direct in open beds at this time. Sowing the seed in boxes and pricking out in seedling trays is even safer.

WINTER RIPENING OF GREEN TOMATOES

By Basil P. Krone, Tomato Culturist

Many market gardeners in the farming areas adjacent to Melbourne grow late crops of tomatoes. The seedlings are planted out about Christmas week and sometimes later, in order that harvesting can be commenced about the third or fourth week in April for the high prices prevailing at that time ; but during the months of May and June, with the onset of wintry weather, tomatoes cease to ripen and hundreds of cases of otherwise good tomatoes are left to rot in the field.

Larger quantities of local tomatoes would favorably compete for the high prices ruling late in the season if they could be saved from the wet and frosty weather and satisfactorily ripened. This can be done at a reasonable cost, and portion of the loss of late tomatoes overcome if the suggestions in this article are followed.

THE main essentials for satisfactory ripening are temperature, light, and controlled ventilation. All of these factors are important in determining good colour.

Temperature

Temperature controls the rate of ripening, but, in ripening rooms with insufficient ventilation, the temperature must not exceed 65 degrees F., otherwise condensation of moisture occurs and the fruit develops a dull, pale-red colour, to say nothing of serious fungal rots, which increase under such humid conditions. Temperatures lower than 60 degrees F. retard the ripening process, and, if the fruit does colour at all, it becomes a dull, pale-red hue.

Sufficient, but controlled, *ventilation* permits the ripening to be hastened at increased temperatures, up to 75 degrees F. if necessary, without condensation occurring. This ventilation and the heating devices should be controlled in the perfect ripening room to keep the room as near to the desired temperature as possible, and prevent the appearance of drops of moisture on the fruit.

Light

Light assists in the development of colour. It has been found that, if light can be admitted to the ripening room, even green tomatoes will develop a good, red colour. In the absence of a glass roof and windows for the admission of sunlight, electric light may be used, but results are not so good.

According to the condition of the fruit and temperature and lighting conditions, tomatoes require from five days to a fortnight to ripen to a stage suitable for marketing. If longer periods are required, it will be found that most varieties, although remaining edible, have a tendency to soften. This condition can be guarded against to a certain extent by slightly increasing the temperature, and, if necessary, the ventilation.

In some of the tests made, it was shown that, where seed from green tomatoes failed to germinate, a 90-per-cent. germination was obtained from seed from similar fruit slowly ripened by the method described.

The Ripening Room

First, it is necessary to erect a ripening room. The structure and heating devices suggested are obviously not suited to a precise control of temperature and humidity such as would be possible in a fully-insulated and specially-designed room with automatic heat control ; but, in practice, the relatively simple structure and devices mentioned have given satisfactory results and should be of interest to the grower whose work does not justify a more expensive installation.

The suggested room is of the skillion type with a glass roof sloping towards the north. The front and side walls could consist of cement sheets, or other suitable material up to a height of, say, 4 feet, with glass 2 feet above. Glass is not required in the back wall. A 6-in. flooring board, however,

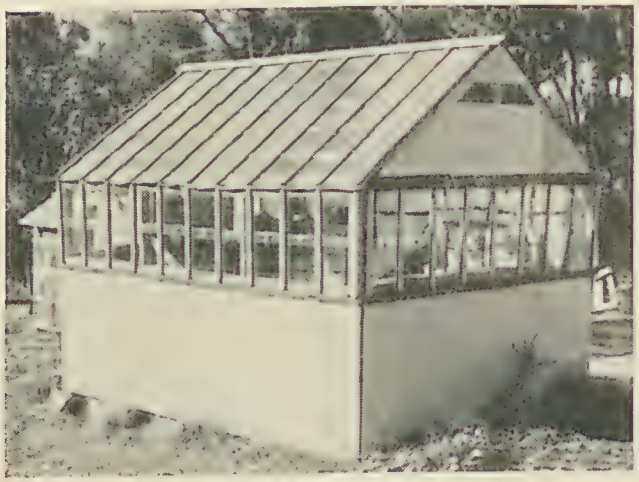
should be let in at the top of the back wall and fastened by hinges at the top of the board, and a similar board near the bottom on the opposite side, to control the ventilation.

Artificial heating can be efficiently provided, very cheaply, by obtaining a few 6-ft. lengths of 4-in. flue piping (similar to ordinary "down" piping used by plumbers) to extend around three sides of the room, four 4-in. 90-degree bends, and a small kerosene stove, such as the "blue flame" type; the cost of the stove, which is about the size of an ordinary "primus" would not be very great.

One of these stoves will ripen up to 500 cases of green tomatoes at a time, at the surprisingly low cost of approximately ¾d. per hour, but, if a grower had smaller quantities of fruit, say, up to 100 cases, an ordinary brooder lamp should do.

The installation can be of a temporary nature, so that it may be removed and stacked away when the ripening season has ended.

To instal the heating device, place the pipes around three sides of the room, about 3 inches from the wall; connect the pipes at the corners with the "bends" (do not use "elbows"; hot air flows around curves much better than it does around right angles); then place the lamp or stove at one end and fit a "bend" on the end of the pipe and invert it over the flame; another bend should be placed on the exit end of the piping and turned either up or sideways in order to control the flow of hot air.



A gable type tomato ripening room.

The hot air should be discharged inside the room, not wasted outside. It will be observed that a large percentage of the heat is produced by radiation from the pipe in addition to the hot air; also the hot air will be more evenly distributed if the "bend" is used on the end of the pipe as previously suggested. It gives better control than a "damper".

Brackets fixed to the wall would serve to support the pipes, which should be just slightly off the horizontal, say, a rise of 2½ to 3 inches in 6 feet, because hot air naturally rises and this will cause it to flow more easily. The installation should be kept as near to the floor as possible. In cold weather, in less-tightly constructed rooms, temperatures may fall below the optimum at night, but, on observations to date, the only effect of this would be to slightly delay ripening.

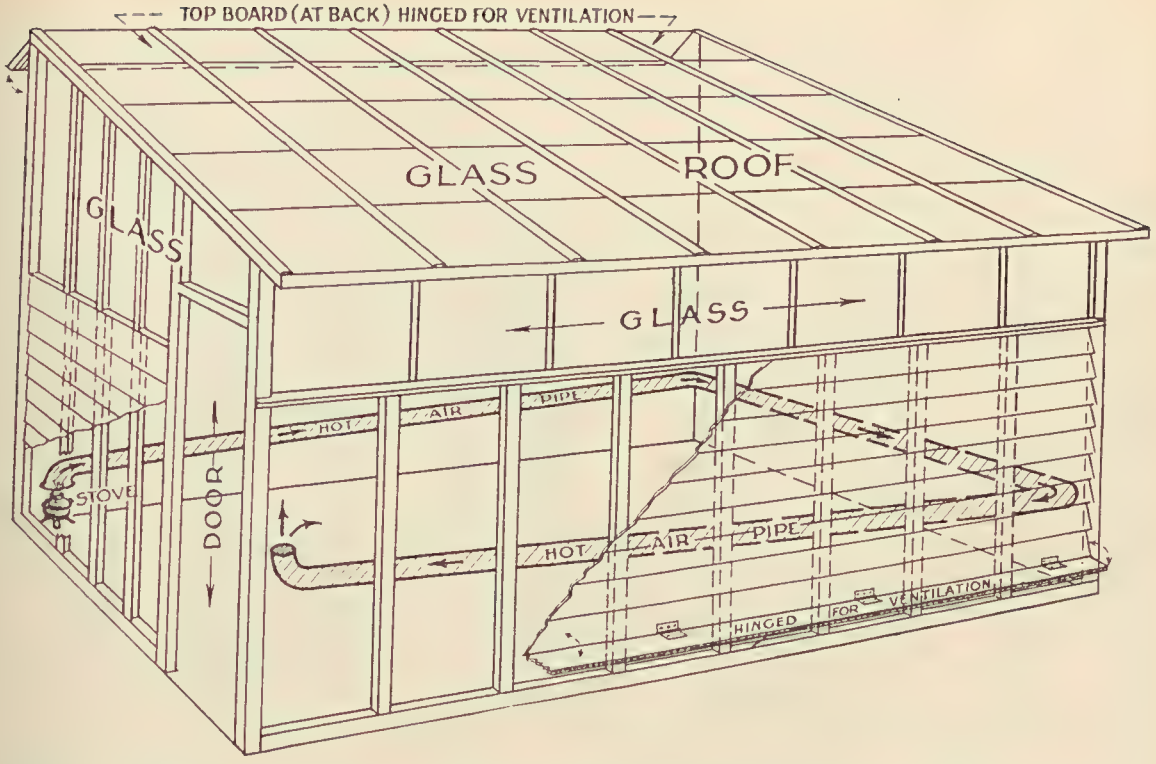
A room 12 feet long, 10 feet wide, and 8 feet high will accommodate 300 cases, and is a very useful size for the average grower.

The tomatoes should be loosely held in "flat" bushel cases, which should be stacked as openly as the quantity to be ripened in the room will permit, to allow free entrance of warmth and light to all fruit. "Staggered" stacking is an excellent idea.

The above described type of ripening room can be greatly improved by constructing the floor of battens spaced 1 inch apart, and raising it about 3 feet from the ground. The height of the floor would then be on a level with a waggon for unloading purposes, and the heating device, greatly modified and improved, could be placed beneath the floor, leaving more space for the fruit.

The lamp or stove for heating is then placed on the ground beneath the floor, in a central position. 4-in. piping is not required. Instead, an inverted gable (angle about 15 degrees) is placed a few inches above the stove. The edges of the gable should reach to within about 2 ft. 6 in. of the wall all round. Galvanized iron is the most suitable material for this purpose. Old corrugated iron gives excellent results.

The whole of the space from the ground to the floor around the ripening room should be securely covered. If galvanized iron is used, it should be well insulated to conserve the heat,



Plan for a suggested ripening room for tomatoes, 15 feet long, 10 feet wide, 8 feet high at front, 9 ft. 6 in. at rear. These measurements could be altered to suit individual requirements. The glass roof should be covered on frosty nights, if the heater is not in use, to prevent frost-injury to the top layers of fruit.

which otherwise would escape, because of the great heat-conducting qualities of the iron. Other information previously described applies also to this ripening room.

Frame without heater

A glass frame without artificial heat and cheaply constructed will also ripen green tomatoes in the winter. The sides should be constructed of cement sheet, or other similar material, and have a removable glass top. A skillion-type cold frame as used for raising tomato seedlings would be suitable. The aspect of the frame must be northerly to trap maximum rays from the sun. Two rows of flat bushel cases may be ripened at a time.

The cases in the first layer are spaced 8 to 10 inches apart and rest on battens or a thin layer of straw.

The cases in the second layer are placed over the spaces created by the cases beneath. This permits maximum penetration of light, warmth, and ventilation. The frame should be made as air tight as possible, in order to control the ventilation. On sunny days, the top should be opened slightly by placing small pieces of wood beneath the glass, but, on the north side, if the wind is from the south, and on the south side if the wind is from the north. About 4 o'clock in the afternoon the frame should be tightly closed and thick bagging thrown over the top to retain as much of the days accumulated warmth as possible.

A glass frame is recommended for people having not more than 25 to 30 cases to ripen. To ripen 25 cases a frame about 25 feet long would be required. Such a frame would pay for itself if, after the ripening period, it could be used in the production of seedlings of some kind.

Warning

In most ripening rooms, oxygen in the atmosphere tends to become exhausted and people should not remain inside the room for any length of time with the door closed.

List of Fungicides, Insecticides, Vermin Destroyers and Weed Destroyers Registered at the Office of the Director of Agriculture under the Fungicides Act 1935 (No. 4295) for the Year 1949.

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).				Wholesale Dealer.
	Arsenic Pentoxide (As_2O_5) Calculated on the Dry Basis.		Acidity Calculated as Nitric. Dry Basis.	Content of Water.	
	Total.	Water Soluble.			
	Minimum.	Maximum.	Maximum.	Maximum.	
Arsenate of Lead (Paste).	%	%	%	%	
Hipple	32·0	·50	·2	50·0	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Berger's Mercury	31·0	·50	·2	50·0	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
Blue Bell	31·0	·50	·2	50·0	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant	31·0	·50	·2	50·0	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	31·0	·50	·2	50·0	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Ramtre	31·5	·25	·2	50·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Vallo	32·0	·50	·2	50·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Tip Top	31·0	·50	·2	50·0	Law, Somner Pty. Ltd., 21 Elizabeth-street, Melbourne
Pannifex's	31·0	·50	·2	50·0	H. C. Pannifex and Co. Pty. Ltd., 53-57 Munster-terrace, North Melbourne, N.1
Lane's	31·0	·32	·2	50·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Challenge	32·0	·50	·2	50·0	Wright, Stephenson and Co. (Aust.) Pty. Ltd., 34 Queen-street, Melbourne
Arsenate of Lead (Powder).					
Blue Bell	31·0	·50	·2	..	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Arsinette	31·0	·50	·2	..	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Elephant	31·0	·50	·2	..	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	31·0	·50	·2	..	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Ramtre	31·5	·25	·2	..	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Plane	31·0	·50	·2	..	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
Vallo	32·0	·50	·2	..	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Berger's Mercury	31·0	·50	·2	..	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
Pannifex's	31·0	·50	·2	..	H. C. Pannifex and Co. Pty. Ltd., 53-57 Munster-terrace, North Melbourne
Lane's	31·0	·50	·2	..	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Challenge	32·0	·50	·2	..	Wright, Stephenson and Co. (Aust.) Pty. Ltd., 34 Queen-street, Melbourne
Tip Top	31·0	·50	·2	..	Law, Somner Pty. Ltd., 21 Elizabeth-street, Melbourne
Hipple	32·0	·50	·2	..	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Calcium Arsenate.					
Hipple	40·0	..	..	..	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Elephant	40·0	..	..	..	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	40·0	..	..	..	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Vallo	40·0	..	..	..	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Tip Top	40·0	..	..	..	Law, Somner Pty. Ltd., 21 Elizabeth-street, Melbourne
Sulphate of Copper (Bluestone).	%				
Blyth's	Copper (Cu) 25·0	..	..	..	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Jaques'	,, 25·0	..	..	..	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Macclesfield	,, 25·0	..	..	..	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne, C.1
Neptune	,, 25·0	..	..	..	,, ,, ,, ,, ,, ,, ,,
Neptune Snow	,, 25·0	..	..	..	,, ,, ,, ,, ,, ,, ,,
Hart's Sugar Bluestone	,, 25·0	..	..	..	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Hipple	,, 25·0	..	..	..	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond

	Percentage Copper (Cu).	Percentage Copper (Cu) Water Soluble.	Percentage through 200-mesh Sieve.	
Basic Copper Salts.	%	%	%	
I.C.I. A.N.Z. (Carbonate)	52·0	Nil	99·0	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
Smutol (Oxychloride)	52·0	Nil	99·0	" " " " " " "
Vallo Anti-Bunt (Oxychloride)	52·0	Nil	99·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Cuprox (Oxychloride)	50·0	..	..	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Elliott's Bunticide	50·0	..	..	D. G. Officer Pty. Ltd., 90 William-street, Melbourne
Vallo Copper Spray (Oxychloride) ..	50·0	..	..	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Oxi-Cop. (Oxychloride)	50·0	..	..	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Copper-50-Spray (Oxychloride)	50·0	..	..	" " " " " " " "
Kopi (Oxychloride)	50·0	..	..	" " " " " " " "
Lion (Oxychloride)	50·0	..	..	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Soltosan (Oxychloride)	50·0	..	..	G. W. Allan, 328 Flinders-street, Melbourne
Bordeaux Mixture.		%		
Hipple (powder)	Copper (Cu)	12·50 ..	.. ..	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Lion (powder)	"	12·50 ..	.. ..	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Vallo (powder)	"	12·50 ..	.. ..	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Lane's Bordo (powder)	"	12·50 ..	.. ..	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Bord-O-Kwik (paste)	"	17·5 ..	.. ..	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Spor-o-cide (powder)	"	12·5 ..	.. ..	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Tip Top (powder)	"	12·5 ..	.. ..	Law, Somner Pty. Ltd., 21 Elizabeth-street, Melbourne
Burgundy or Copper-Soda.				
Neptune Copper Spray	Copper (Cu)	12·5 ..	.. ..	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
Blue Bell	"	12·0 ..	.. ..	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant	"	12·0 ..	.. ..	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Paris Green.		%		
Felton, Grimwade, and Duerdin's ..	Arsenious Oxide (As_2O_3)	50·0 ..	.. ..	Felton, Grimwade, and Duerdin's Pty. Ltd., 342–6 Flinders-lane, Melbourne
Nosco	" " "	50·0 ..	.. ..	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Tip Top	" " "	50·0 ..	.. ..	Law, Somner Pty. Ltd., 21 Elizabeth-street, Melbourne
Lion	" " "	50·0 ..	.. ..	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Moon	" " "	53·0 ..	.. ..	T. S. Nettlefold and Sons Pty. Ltd., 189 King-street, Melbourne
Miscellaneous Copper Compounds.				
Hipple Cheshunt Compound	Copper (Cu)	4·0 (on dry basis)	..	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Bordinette	"	12·7 ..	.. ..	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Bordesan Colloidal Copper	"	15·0 ..	.. ..	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Lime.		%		
Neptune	Available Lime (CaO)	80 ..	..	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).			Wholesale Dealer.
	Thio-Sulphate Sulphur.	Poly-Sulphide Sulphur.	Total Soluble Sulphur.	
	Weight in Volume.			
Concentrated Lime-Sulphur (Solution).	%	%	%	
Hipple	2·5	20·0	28·0	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Blue Bell	2·5	20·0	28·0	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant	2·5	20·0	28·0	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	2·5	20·0	28·0	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Neptune	2·5	20·0	28·0	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
Vallo	2·5	20·0	28·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
X.L.	2·5	20·0	28·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Harola	1·5	20·0	28·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Tip Top	2·5	20·0	28·0	Law, Somner Pty. Ltd., 21 Elizabeth-street, Melbourne
	Sulphur.		Calcium Hydrate.	
Lime and Sulphur (Dry Mix).	%		%	
Pannifex	62·5		35·5	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
Vallo	64·0		35·6	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Sulphur.	%			
Commonwealth (Dusting)	Sulphur 90·0			Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
,, (Powdered)	,, 99·5			,, ,, ,, ,, ,, ,, ,, ,,
,, (Atomic Dusting)	,, 90·0			,, ,, ,, ,, ,, ,, ,, ,,
,, (Atomic)	,, 99·5			,, ,, ,, ,, ,, ,, ,, ,,
,, (Wetomic)	,, 97·0			,, ,, ,, ,, ,, ,, ,, ,,
Flotox	,, 95·0			H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
Lion (Atomic)	,, 90·0			Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Neptune (Powdered)	,, 99·0			Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
Vallo (Powdered)	,, 99·5			Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
,, (Dusting)	,, 90·0			,, ,, ,, ,, ,, ,, ,, ,,
,, (Wettable)	,, 98·0			,, ,, ,, ,, ,, ,, ,, ,,
,, (Colloidal)	,, 50·0			,, ,, ,, ,, ,, ,, ,, ,,
Wetsul	,, 97·0			Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Plane (Dusting)	,, 90·0			N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
Blue Bell (Colloidal)	,, 50·0			Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant (Colloidal)	,, 50·0			Jaques Pty. Ltd., 31 Queen-street, Melbourne
Hipple (Dusting)	,, 90·0			Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Spregan (Colloidal)	,, 55·0			Spregan Colloidal Sulphur Pty. Ltd., 90 Queen-street, Melbourne
Cosan (Colloidal)	,, 50·0			Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Spersul	,, 73·0			Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Lion (Wettable)	,, 97·0			Orchard Sprays Pty. Ltd., 549 Church-street, Richmond

Nicotine Sulphate.		%	
Hipple	Nicotine	40	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Blue Bell	„	40	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant	„	40	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Lion	„	40	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Plane	„	40	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
Vallo	„	40	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Black Leaf 40 (Neptune)	„	40	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
Neptune	„	40	
Hart's	„	40	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Nik-kof	„	40	Clark, King and Co. Pty. Ltd., 237 Queen-street, Melbourne
Tip Top	„	40	Law, Somner Pty. Ltd., 21 Elizabeth-street, Melbourne
Lane's Black Leaf 40	„	40	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Tar Distillate.		%	
Ovicide	Tar Oil	48	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
	Phenols	10	
	Mineral Oil	20	
Vallo Ovicidal Wash	Emulsifiable Oils	89	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Blue Bell	„ „	89	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant	„ „	89	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Hipple	„ „	89	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Winterwash A	Tar Oil	70	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Wintrol (Tar Oil)	Anthracene Oil	50	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
	Phenols	8	
	Mineral Oil	12	
Challenge	Tar Oil	70	Wright, Stephenson and Co. (Aust.) Pty. Ltd., 34 Queen-street, Melbourne
Lion	„ „	70	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
White Spraying Oil or Emulsion.		%	
Hipple	White Mineral Oil	80·0	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Blue Bell	„ „ „	82·0	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Alboleum	„ „ „	80·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Elephant	„ „ „	82·0	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Gargoyle	„ „ „	82·5	Vacuum Oil Co. Pty. Ltd., 29 Market-street, Melbourne
Kleenup	„ „ „	83·0	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
Lion	„ „ „	80·0	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Neptune	„ „ „	84·0	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
„ Clarifol	„ „ „	85·0	
Vallo	White Mineral Oil	82·5	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Volck	„ „ „	83·0	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
Shell White Spray	„ „ „	84·0	Shell Co. of Australia Ltd., 163 William-street, Melbourne
X.L.	„ „ „	80·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Atlantic	„ „ „	86·0	Atlantic Union Oil Co. Ltd., 396 Collins-street, Melbourne, C.1
„ Emulsified	„ „ „	72·0	
Albarol	„ „ „	80·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Challenge	„ „ „	90·0	Wright, Stephenson and Co. (Aust.) Pty. Ltd., 34 Queen-street, Melbourne
Tip Top	„ „ „	80·0	Law, Somner Pty. Ltd., 21 Elizabeth-street, Melbourne
Pale Spraying Oil.		%	
Gargoyle	Pale Mineral Oil	82·5	Vacuum Oil Co. Pty. Ltd., 29 Market-street, Melbourne
Neptune Palsol	„ „ „	85·0	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
Shell Pale-Spray	„ „ „	85·0	Shell Co. of Australia Ltd., 163 William-street, Melbourne
Shellicide D.	„ „ „	85·0	
Vallo	„ „ „	82·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Challenge	„ „ „	70·0	Wright, Stephenson and Co. (Aust.) Pty. Ltd., 34 Queen-street, Melbourne
Lane's	„ „ „	80·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).	Wholesale Dealer.
Red Spraying Oil.	%	
Hipple	Red Mineral Oil 85·0	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Blue Bell	" " " 85·0	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant	" " " 85·0	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Gargoyle	" " " 85·0	Vacuum Oil Co. Pty. Ltd., 29 Market-street, Melbourne
Gargoyle M.	" " " 82·5	" " " " " "
Lion	" " " 85·0	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Neptune "A"	" " " 83·0	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
" "C"	" " " 70·0	" " " " " "
Shell Red Spray	" " " 83·0	Shell Co. of Australia Ltd., 163 William-street, Melbourne
Vallo	" " " 85·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
X.L.	" " " 85·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
X.L. (Emulsion)	" " " 82·0	" " " " " "
Atlantic	" " " 89·0	Atlantic Union Oil Co. Ltd., 396 Collins-street, Melbourne, C.1
Harbas	" " " 75·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Tip Top	" " " 80·0	Law, Somner Pty. Ltd., 21 Elizabeth-street, Melbourne
Winter Spraying Oil.	%	
Shell Universal Winter Spray	Solution Nitrated Phenols in Oil 85·0	Shell Co. of Australia Ltd., 163 William-street, Melbourne
Winsol	" " " " 85·0	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
Vallo D.N.C.	" " " " 85·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Miscellaneous Spraying Oil.	%	
Capsine D.N.O.C. Dormant Ovicidal Spray	Mineral Oil 72·0 Dinitroorthocresol 2·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
D.N.C. (Spraying Oil)	Mineral Oil 80·0 Dinitroorthocresol 2·5	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Arsenic (Oxides).	%	
Vallo (White)	Arsenic (As_2O_3) 98·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
" (Pentoxide) Granulated	Arsenic Pentoxide (As_2O_5) 83·0	" " " " " "
Hart's (White)	Arsenic (As_2O_3) 99·5	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Felton, Grimwade, and Duerdin's (White)	" " 98·0	Felton, Grimwade, and Duerdins Ltd., 342-6 Flinders-lane, Melbourne
Snail and Slug Killers.	%	
Bug-Geta	Metaldehyde 1·5	Guano Plant Force and Pest Control Co., 53-57 Munster-terrace, North Melbourne
Sure Death	" 1·5	Sure Death Laboratories, 2A Lunan-avenue, Drumcondra, Geelong
Defender	" 1·25	Law, Somner Pty. Ltd., 21 Elizabeth-street, Melbourne
Eat-N-Die	" 1·0	Kag Manufacturing Co., 4 Wood-street, Fitzroy
Slugtox	" 1·5	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Brown Magic	" 1·0	E. H. Page, 1264 High-street, Malvern
Instant 265	Metaldehyde 1·4 Arsenic (As_2O_3) ·75	M. A. B. Grant, Beaconsfield
K.O. 4	Metaldehyde 1·0 Sodium Fluosilicate 10·0	A. B. Gibson and Sons Pty. Ltd., cr. Stubbs and Robertson streets, Kensington
Taylor's No. 13	Metaldehyde 1·46	T. S. Nettlefold and Sons Pty. Ltd., 189 King-street, Melbourne
Metaslug	" 1·0	Ormond Plant Farm Pty. Ltd., Lillimur-road, Ormond
Killsem	" 1·25	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Snaildeath	" 1·5	Shift-It Products, 4 Roden-street, West Melbourne
Avery	" 1·5	R. Avery Fertilizer Co. Pty. Ltd., 25 Victoria-place, Carlton
Betabait	" 1·5	Hodge, Moody and Co. Pty. Ltd., 5 Gordon-street, Richmond
Stirling	" 1·0	Stirling Nurseries, Beach-road, Torquay
David Gray's	" 1·5 Arsenic (As_2O_3) ·25	Woodell Agencies Ltd., 578 Bourke-street, Melbourne

Miscellaneous.

		%	
Felton, Grimwade, and Duerdin's Formalin	Formaldehyde	38·0	Felton, Grimwade, and Duerdins Pty. Ltd., 342 Flinders-lane, Melbourne
I.C.I. A.N.Z. Carbon Bisulphide	Carbon Bisulphide	99·0	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
Vallo Tree Bands	D.D.T.	1·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
	Beta-naphthol	20·0	
Shirlan A.G.	Salicylanilide	25·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
	Sulphonated Organic Matter	25·0	
„ W.S.	Sodium Salicylanilide	98·0	„ „ „ „ „ „ „
„ (100%)	„ „	100·0	„ „ „ „ „ „ „
Ceresan	Mercury	1·5	Dalgety and Co. Ltd., 461–71 Bourke-street, Melbourne
Germisan	Sodium salt of Cyan-mercury cresol	30·0	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
	Sodium chloride	60·0	
Lunasan	Organically combined mercury	·54	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Agrosan	„ „ „	1·5	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
Tuberol	Stearoptenes and Oleoptenes	70·0	H. C. Panifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
Grenedeth	Nicotine	0·58	E. H. Page, 1264 High-street, Malvern
	Sulphur	18·19	
	Paradichlorobenzene	2·27	
	Residual Oil	4·22	
	Naphthalene	2·26	
	Oil of Citronella	2·0	
Clensel	Ammonia	2·3	Clensel Products Pty. Ltd., Youell and Cowper streets, Footscray
	Potash Soap	60·0	
	Naphthalene	10·0	
Killamite Manurial Insecticide	Tar Acids	1·0	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
	Copper	1·0	
	Sulphur	2·0	
Fluorocide	Sodium Aluminium Fluoride	90·0	Sulphates Pty. Ltd., 395 Collins-street, Melbourne
Wilto Soil Treatment	Ethyl mercury phosphate	0·5	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
	Paradichlorobenzene	3·0	
	Copper	12·0	
	Phenol	5·5	
	Sodium fluosilicate	12·5	
Jen's Poultry Louse Powder	Tar Salts	2·5	Jen's Vet. Products, 443 Little Collins-street, Melbourne
	Sulphur	2·5	
	Tobacco dust	·4	
Sickle or I.C.I. Formalin	Formaldehyde	38·0	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
Hipple Formalin	„	40·0	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Lane's Tree Bands	Beta-naphthol	10·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
	D.D.T.	2·0	
Vallo Manurial Insecticide	Naphthalene	50·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
	Sulphur	5·0	
Shell D–D Soil Fumigant	Chlorinated Hydrocarbons	100·0	Shell Co. of Aust. Ltd., 163 William-street, Melbourne
Tetroc	Tetrachloroparabenzoquinone	99·0	Wright, Stephenson and Co. (Aust.) Pty. Ltd., 34 Queen-street, Melbourne
Tetroc Seed Protectant	„ „ „	98·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Aretan	Mercury	3·0	G. W. Allan, 328 Flinders-lane, Melbourne
Felton's Argentine Ant Poison	Sodium Arsenite	0·12	Felton, Grimwade, and Duerdin's Pty. Ltd., 342 Flinders-lane, Melbourne
		%	
E.605 Liquid Concentrate	Diethyl-para-nitrophenol thiophosphate	44·8	Henry H. York and Co. Pty. Ltd., 573 Lonsdale-street, Melbourne
E.605 Insecticidal Dust	„ „ „ „	1·5	Henry H. York and Co. Pty. Ltd., 573 Lonsdale-street, Melbourne
P.A.C.A. Funigicide	Phenyl-amino-cadmium acetate	20·0	E. P. Keogh Pty. Ltd., 402 Swanston-street, Melbourne
Insecto	D.D.T.	25·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
	Hexa-ethyl Tetraphosphate	15·6	
Lane's Destructol	D.D.T.	5·0	„ „ „ „ „ „ „ „
	Isobornyl Thiocyano-acetate	25·0	
Kylpest Derris Wash	Rotenone	1·1	„ „ „ „ „ „ „ „
	D.D.T.	5·0	
"D." Death Poultry Spray	D.D.T.	2·0	J. D. Harmsworth and Co. Pty. Ltd., 185 William-street, Melbourne
	Cresylic Acid	5·5	

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).	Wholesale Dealer.
Nicotine Dusting Powders.	%	
Plane Nicodust No. 3	Nicotine 3·00	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
,, ,, No. 5	,, 5·00	,, ,, ,, ,, ,, ,,
Elephant Duston No. 1	,, 4·00	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Ramtre No. 4	,, 2·00	Ramsay and Treganown Ltd., 475 Latrobe-street, Melbourne
,, No. 5	,, 3·00	,, ,, ,, ,, ,, ,,
,, No. 6	,, 4·00	,, ,, ,, ,, ,, ,,
Vallo N.40	,, 2·50	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Victory	,, 3·00	R. H. Nankervis, 317 St. Kilda-street, Middle Brighton
Pestend Tobacco Dust	,, 0·50	W. D. and H. O. Wills (Aust.) Ltd., 411 Swanston-street, Melbourne
Arsenical Dusting Powders.	%	
Plane A.P. No. 50	Arsenic Pentoxide (As_2O_5) 15·5	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
Vallo "A.L." 50	,, ,, ,, 16·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Lane's A.P. 50	,, ,, ,, 15·5	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Copper Dusting Powders.	%	
Plane Coppodust No. 7	Copper (Cu) 7·00	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
,, ,, No. 11	,, 11·00	,, ,, ,, ,, ,, ,,
Raintre No. 14	,, 8·00	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Victory	,, 8·75	R. H. Nankervis, 317 St. Kilda-street, Middle Brighton
Rotenone Dusting Powders.	%	
Pulvex (Cooper's)	Rotenone 1·00	New Zealand Loan and Mercantile Agency Co. Ltd., 538 Collins-street, Melbourne
Drymac	,, ·25	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Katakilla	,, 1·00	,, ,, ,, ,, ,, ,,
Derrisdust	,, 0·75	Houghton and Byrne Pty. Ltd., 268 Flinders-street, Melbourne
Derris Dust	,, 0·75	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
D.D.T. Dusting Powders.	%	
Plane Noxide No. 100	D.D.T. 1·00	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
,, ,, No. 200	,, 2·00	,, ,, ,, ,, ,, ,,
,, ,, No. 500	,, 5·00	,, ,, ,, ,, ,, ,,
Hipple	,, 2·00	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Pespruf No. 2.	,, 2·00	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Deedust	,, 2·00	,, ,, ,, ,, ,, ,,
No-Verm	,, 2·00	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne

Taubman's 2 per cent.	„ 2·00	Taubman's Pty. Ltd., 24 Lonsdale-street, Melbourne
„ 5 per cent.	„ 5·00	„ „ „ „ „ „
„ 15 per cent.	„ 15·00	„ „ „ „ „ „
„ Rudust (Cabbage)	„ 2·00	„ „ „ „ „ „
„ Linseed Dust	„ 5·00	„ „ „ „ „ „
„ 1 per cent.	„ 1·00	„ „ „ „ „ „
Horto-Kix	„ 2·00	Clark, King and Co. Pty. Ltd., 237 Queen-street, Melbourne
Victory	„ 2·00	R. H. Nankervis, 317 St. Kilda-street, Middle Brighton
Neptune Float-On No. 2	„ 2·00	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
„ Float-On No. 1	„ 5·00	„ „ „ „ „ „
Caulicab	„ 1·75	Houghton and Byrne Pty. Ltd., 268 Flinders-street, Melbourne
David Gray's 2 per cent. Garden Dust	„ 2·00	Woodell Agencies Ltd., 578 Bourke-street, Melbourne
„ „ „ „ Agricultural Dust	„ 2·00	„ „ „ „ „ „
„ „ Insect Powder	„ 5·00	„ „ „ „ „ „
Taylor's No. 13	„ 5·00	T. S. Nettlefold and Sons Pty. Ltd., 189 King-street, Melbourne
Lion	„ 2·00	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond

Benzene Hexachloride Dusting Powders.

	Benzene hexachloride %	
Gammexane No. 4	·5	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
„ No. 10	1·3	„ „ „ „ „ „ „
„ No. 20	2·6	„ „ „ „ „ „ „
„ Smoke Generator (Nos. 2 & 12)	3·2	„ „ „ „ „ „ „
„ „ „ No. 22	16·0	„ „ „ „ „ „ „
Plane Gammacide No. 2	·26	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
„ „ No. 3	·39	„ „ „ „ „ „
„ „ No. 5	·52	„ „ „ „ „ „
Kilpest No. 4	0·5	R. H. Nankervis, 317 St. Kilda-street, Middle Brighton
B.H.C. 4	0·5	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
„ 10	1·3	„ „ „ „ „ „ „ „
„ 20	2·6	„ „ „ „ „ „ „ „

Mixed Dusting Powders.

	Nicotine. %	Arsenic Pentoxide (As_2O_5). %	Tar Oil. %	Sulphur. %	
Plane A.P. No. 50N	2·00	15·50	..	..	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
„ „ No. $50N_2$	3·00	15·50	..	..	„ „ „ „ „ „
Elephant Duston No. 2	1·20	5·00	..	..	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Vallo N.3 A.L.30	3·00	9·60	..	..	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Plane Aphidust No. 2	2·00	..	3·00	..	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
„ Peamite No. 2	2·50	..	4·00	..	„ „ „ „ „ „
Neptune Float-On No. 7	2·50	15·50	..	..	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne

	Arsenic Pentoxide (As_2O_5). %	Copper (Cu). %	Sulphur. %	
Plane Tomato No. 50	15·5	4·0	40·0	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
„ Azurine No. 20	6·2	7·0	40·0	„ „ „ „ „ „
Vallo Tomato and Vegetable No. 1	16·0	5·0	40·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
„ „ „ „ No. 2	8·0	5·0	40·0	„ „ „ „ „ „
„ „ „ „ No. 3	12·8	3·0	40·0	„ „ „ „ „ „
Tomato No. 2	7·8	4·0	40·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Plane Azurine No. 2	..	7·0	40·0	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
„ „ No. 4	..	11·0	35·0	„ „ „ „ „ „
Neptune Float-On No. 6	15·5	5·0	40·0	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Names of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).				Wholesale Dealer.
	D.D.T.	Nicotine.	Copper (Cu).	Sulphur.	
Mixed Dusting Powders—continued.	%	%	%	%	
Plane Noxide No. 100N	1·00	1·00	..	..	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
" " No. $100N_2$	1·00	2·00	..	..	" " " " " "
" " No. 200N	2·00	1·00	..	..	" " " " " "
" " No. $200N_2$	2·00	2·00	..	..	" " " " " "
Vallo D.D.T.N. Vegetable	2·00	3·00	..	..	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Plane Azurine No. 100	1·00	..	7·00	40·00	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
" " No. 200	2·00	..	7·00	40·00	" " " " " "
" " No. 400	1·00	..	11·00	35·00	" " " " " "
Tomato No. 1	2·00	..	4·00	42·00	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Pespruf No. 5	2·00	..	7·50	40·00	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Plane Tomato No. 200	2·00	..	4·00	40·00	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
Pespruf No. 3	2·00	..	7·00	..	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
"D" Death	2·00	..	2·50	..	J. D. Harmsworth and Co. Pty. Ltd., 185 William-street, Melbourne
Challenge E	2·00	..	4·00	40·00	Wright, Stephenson and Co. (Aust.) Pty. Ltd., 34 Queen-street, Melbourne
Neptune Float-On No. 5	2·00	..	5·00	40·00	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
" " No. 3	2·00	2·50	..	..	" " " " " "
Rudust No. 1 (Tomato)	2·00	..	4·00	40·00	Taubmans Pty. Ltd., 24 Lonsdale-street, Melbourne
" No. 2 "	2·00	..	..	50·00	" " " " " "
" No. 3 "	1·00	..	..	50·00	" " " " " "
" No. 4 "	1·00	..	4·00	40·00	" " " " " "

	D.D.T.	Benzene Hexachloride.	
	%	%	
Pespruf No. 26	1·0	·13	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Killpest No. 3	1·0	·13	R. H. Nankervis, 317 St. Kilda-street, Middle Brighton
Plane Noxide No. $100G_1$	1·0	·13	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
" " No. $100G_2$	1·0	·26	" " " " " "
" " No. $100G_3$	1·0	·39	" " " " " "
" " No. $200G_2$	2·0	·26	" " " " " "
Neptune Float-On No. 8	2·0	·26	Neptune Oil Pty. Ltd., 532 Bourke-street, Melbourne
Cabbage No. 2	2·0	·26	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Rudust Duplex	2·0	·26	Taubmans Pty. Ltd., 24 Lonsdale-street, Melbourne

		%	
Pestox No. 3	D.D.T. ..	1·0	Samuel Taylor Pty. Ltd., 66 Hardware-street, Melbourne
	Rotenone ..	0·5	
	Sulphur ..	20·0	
Composite	D.D.T. ..	2·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
	Pyrethrins ..	0·1	
Plane G.P.	D.D.T. ..	2·0	N. N. McLean Pty. Ltd., 395 Queen-street, Melbourne
	Copper ..	4·0	
	Sulphur ..	40·0	
	Benzene Hexachloride ..	0·26	
Plane Azurine No. 3G2 ..	Copper ..	9·8	" " " " " "
	Sulphur ..	35·0	
	Benzene Hexachloride ..	0·26	
Neptune Float-On No. 4 ..	D.D.T. ..	2·0	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
	Pyrethins ..	0·13	

	%	
D.D.T. Solutions and Powders.		
Pespruf 20 Emulsion	D.D.T. 19·5	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
,, No. 50 Dispersible Powder	,, 50·0	,, ,, ,, ,, ,, ,, ,,
Vermpruf 1A	,, 12·5	,, ,, ,, ,, ,, ,, ,,
,, 3c	,, 15·0	,, ,, ,, ,, ,, ,, ,,
Rucide	,, 50·0	Taubmans Pty. Ltd., 24 Lonsdale-street, Melbourne
Taubman's Rulene	,, 25·0	,, ,, ,, ,, ,, ,, ,,
,, Insecticidal Solution	,, 4·0	,, ,, ,, ,, ,, ,, ,,
Wellspray Emulsion	,, 25·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Emulsane 20	,, 20·0	,, ,, ,, ,, ,, ,, ,,
Lion	,, 25·0	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond ,,
Neptune Emulsion	,, 32·0	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
Isco W.S. 10	,, 10·0	D. G. Officer Pty. Ltd., 90 William-street, Melbourne
Bovox	,, 8·4	Wilcox, Mofflin Ltd., 34 King-street, Melbourne
Kix	,, 9·0	Clark, King and Co. Pty. Ltd., 237 Queen-street, Melbourne
Agro-Kix No. 20	,, 20·0	,, ,, ,, ,, ,, ,, ,,
Wellspray 50	,, 50·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Neptune Aphidol	,, 4·0	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
Shell Aphis Spray	,, 4·0	Shell Co. of Aust. Ltd., 163 William-street, Melbourne
Challenge 40% Dispersible Powder	,, 40·0	Wright, Stephenson and Co. (Aust.) Pty. Ltd., 34 Queen-street, Melbourne
Blue Bell Non-Oil Emulsion	,, 36·0	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant Non-Oil Emulsion	,, 36·0	Jaques Pty. Ltd., 31 Queen-street, Melbourne
David Gray's Water Soluble 20%	,, 20·0	Woodell Agencies Ltd., 578 Bourke-street, Melbourne
,, ,, Water Soluble	,, 9·5	,, ,, ,, ,, ,, ,, ,,
,, ,, Garden Spray 9·5%	,, 9·5	,, ,, ,, ,, ,, ,, ,,
Taylor's No. 13 Emulsion 20%	,, 20·0	T. S. Nettlefold and Sons Pty. Ltd., 189 King-street, Melbourne
,, ,, ,, 9·5%	,, 9·5	,, ,, ,, ,, ,, ,, ,,
Guesarol G.H. 40 Suspensible Powder	,, 40·0	Wilcox, Mofflin Ltd., 34 King-street, Melbourne ,,
,, F.S. 40 ,, ,,	,, 40·0	,, ,, ,, ,, ,, ,, ,,
,, B.W. 40 ,, ,,	,, 40·0	,, ,, ,, ,, ,, ,, ,,
Lion Wettable Powder	,, 40·0	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Emulsane 50 Colloidal Paste	,, 50·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
"D" Death Emulsion	,, 20·0	J. D. Harmsworth and Co. Pty. Ltd., 185 William-street, Melbourne
Benzene Hexachloride Solutions.	%	
Gammexane No. 7 Miscible Oil	Benzene Hexachloride 7·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
,, Liquid L.G. 140	,, ,, 8·7	,, ,, ,, ,, ,, ,, ,,
,, No. 50 Dispersible Powder	,, ,, 6·5	,, ,, ,, ,, ,, ,, ,,
Gamaturf	,, ,, 6·0	,, ,, ,, ,, ,, ,, ,,
Hexaethyl Tetraphosphate.	%	
Hexone	Hexaethyl Tetraphosphate 95·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Vallo H.E.T.P.	,, ,, 95·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Bluebell Demite	,, ,, 95·0	Blyth Chemicals Ltd., 31 Queen-street, Melbourne
Elephant Demite	,, ,, 95·0	Jaques Pty. Ltd., 31 Queen-street, Melbourne
Hetraphos	,, ,, 100·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Blowfly Preparations.	%	
Allkon Blowfly Oil	D.D.T. 5·0 Boric Acid 5·5 Phenol and Homologues 22·2 Orthodichlorbenzene 5·9 Hydro-carbon Oils 8·0 Naphthalene 7·5	Allkon Pty. Ltd., 36 Clarendon-street, South Melbourne
Blo-Fli-Di	Benzol 13·7 Sulphur ·8 Tar Oil 8·4 Hydro-carbon Oils 84·1	The Nightingale Supply Co. (Vic.) Ltd., Ingles-street, Port Melbourne
Shell Defiance Blowfly Oil	Coal Tar Derivatives 12·9 Essential Oils 3·0	The Shell Co. of Australia Ltd., 163 William-street, Melbourne

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).		Wholesale Dealer.
Blowfly Preparations—continued.		%	
Immunol Blowfly Dressing	D.D.T.	5·0	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
	Boric Acid	5·5	
	Phenol and Homologues	22·2	
	Orthodichlorbenzene	5·9	
	Hydro-carbon Oils	8·0	
Way-blo	Eucalyptus Oil	33·33	W. K. Burnside Pty. Ltd., 34–44 Jeffcott-street, Melbourne
	Phenol and Homologues	2·77	
	Chlorinated Benzene	5·55	
Glycerine Di Boric	Boric Acid	21·5	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Osblo	Phenols	2·5	Osmond and Sons (Aust.) Pty. Ltd., 35 William-street, Melbourne
	Eucalyptus	·75	
Immunol C.B.E.	Boric Acid	10·0	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
	Oil of Camphor	13·5	
Vetamac	Boric Acid	8·0	A. H. McDonald, 627–631 Bridge-road, Richmond
	Zinc Sulphate	1·0	
	Tar Oils	8·0	
	Essential Oils	1·0	
	D.D.T.	0·6	
Calarsenite	Arsenious Oxide	43·0	D. G. Officer Pty. Ltd., 90 William-street, Melbourne
Mag-o-Tol	Cresylic Acid	4·0	Goldsbrough, Mort and Co. Ltd., 526 Bourke-street, Melbourne
Mag-o-Tol, plus D.D.T.	Cresylic Acid	4·0	" " " " " " " "
	D.D.T.	1·0	
Squatter Blowfly Oil	Hydrocarbon Oils	84·0	Neptune Oil Co. Pty. Ltd., 532 Bourke-street, Melbourne
	Coal Tar Derivatives	13·0	
	Essential Oils	3·0	
Benkersol	Boric Acid	15·0	D. G. Officer Pty. Ltd., 90 William-street, Melbourne
	Lysol	6·2	
	Orthodichlorbenzene	5·2	
B.H.P. Blowfly Oil	Phenols	10·0	B.H.P. By-Products Pty. Ltd., 422 Little Collins-street, Melbourne
K.F.M. Concentrated D.D.T. Emulsion	D.D.T.	6·0	Wilcox, Mofflin Ltd., 34 King-street, Melbourne
	Tar Acid	7·5	
	Orthodichlorbenzene	15·0	
I.C.I–B.K.B.	Boric Acid	15·0	Imperial Chemical Industries of Aust. and N.Z. Ltd., 408 Latrobe-street, Melbourne
	Lysol	6·2	
	Orthodichlorbenzene	5·2	
Wilmoff B.K.B.	Boric Acid	15·0	Wilcox, Mofflin Ltd., 34 King-street, Melbourne
	Lysol	5·3	
	Orthodichlorbenzene	5·4	
Immunol B.K.B.	Boric Acid	40·0	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
	Cresol	6·7	
	Orthodichlorbenzene	14·2	
	D.D.T.	3·0	
Atlantic	Eucalyptus Oil	10·0	Atlantic Union Oil Co. Ltd., 396 Collins-street, Melbourne
	Cresylic Acid	11·3	
	Eucalyptus Residual Oil	50·0	
Blackers	Naphthalene	5·0	Horn and Co., 132 Little Lonsdale-street, Melbourne
	Cresylic Acid	2·5	
	Eucalyptus Oil	4·0	
Kleenflox	Phenol	3·0	Taubmans Pty. Ltd., 24 Lonsdale-street, Melbourne
	D.D.T.	1·0	
	Mineral Oils	61·0	
Woollo	Neutral Tar Oils	80·0	Australian Estates Co. Ltd., 114 William-street, Melbourne
Sayers D.D.T.	D.D.T.	5·0	Victorian Producer's Co-op. Co. Ltd., 578–584 Little Flinders-street, Melbourne
	Cresylic Acid	2·5	
	Tri-iodo-phenol	5·0	
G.M.X.	Benzene Hexachloride	0·72	Wilcox Mofflin Ltd., 34 King-street, Melbourne
	Tetrachlorethylene	7·5	
	Tar Acids	7·5	

Younghusband	Tar Oil .. 55·0 ..	Younghusband Ltd., 94 King-street, Melbourne
	Whale Oil .. 45·0 ..	
	D.D.T. .. 15·0	
Kleep-Sheep	Chlorinated Benzene .. 44·0 ..	Taubmans Pty. Ltd., 24 Lonsdale-street, Melbourne
	Bactericide .. 1·5 ..	
	Boric Acid .. 15·0 ..	
David Gray's B.K.B. with D.D.T.	Orthodichlorbenzene .. 5·25 ..	
	Lysol .. 5·25 ..	Woodell Agencies Ltd., 578 Bourke-street, Melbourne
	D.D.T. .. 2·0 ..	
	D.D.T. .. 4·0 ..	
Fly-o-leen	Benzene Hexachloride 0·52 ..	Consolidated and Overseas Co. Pty. Ltd., 24 Bond-street, Melbourne
	Tar Acids .. 8·0 ..	
	Orthodichlorbenzene .. 20·0 ..	
	D.D.T. .. 4·0 ..	
Benex	Benzene Hexachloride 0·52 ..	Goldsbrough, Mort and Co. Ltd., 526 Bourke-street, Melbourne
	Tar Acids .. 8·0 ..	
	Orthodichlorbenzene .. 20·0 ..	

Weevil Destroyers.

	%	
Vallo Arsenate of Soda (for treatment of hides)	Arsenic Pentoxide (As_2O_5) 63·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Vacuum Weevil Oil	Pale Mineral Oil .. 82·5	Vacuum Oil Co. Pty. Ltd., 29 Market-street, Melbourne
Shell Weevil Oil	Solution nitrated phenol—oil 85·0	The Shell Co. of Australia Ltd., 163 William-street, Melbourne
David Gray's Weevil Powder	D.D.T. .. .. 3·5	Woodell Agencies Ltd., 578 Bourke-street, Melbourne

Sheep and Cattle Dips (Arsenical).

Cooper's Powder	Conforms with standard (Vic. Dept. of Agric.)	New Zealand Loan and Mercantile Agency Co. Ltd., 538 Collins-street, Melbourne
Little's Powder (Ordinary)	" " " " "	Wilcox, Mofflin Ltd., 34 King-street, Melbourne
Quibell's Powder	" " " " "	Dalgety and Co. Ltd., 461–471 Bourke-street, Melbourne
Sickle Powder	" " " " "	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
Vallo Standard Powder	" " " " "	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Lan-o-leen	" " " " "	Consolidated and Overseas Co. Pty. Ltd., 24 Bond-street, Melbourne
Viper Powder	" " " " "	Osmond and Sons (Aust.) Pty. Ltd., 35 William-street, Melbourne
Kleanflok	" " " " "	J. H. Rudd and Co. Pty. Ltd., 103–105 William-street, Melbourne
Kleanfleece	" " " " "	J. H. Rudd and Co. Pty. Ltd., 103–105 William-street, Melbourne
Young's Powder	" " " " "	Strachan and Co. Ltd., Geelong
Dytic Fluid	" " " " "	Dytic Products Pty. Ltd., 4 Roden-street, Melbourne

Miscellaneous Sheep and Cattle Dips.

		%	
Cooper's Quickacting Powder	Arsenic (As_2O_3)	22·00	New Zealand Loan and Mercantile Agency Co. Ltd., 538 Collins-street, Melbourne
" Milk Oil Fluid	Rotenone and allied substances ..	·70	
	Phenols and Cresols	18·00	" " " " " " " "
Hart's Immunol Super	Arsenic (As_2O_3)	24·50	
	Cresol	33·40	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
	Oleo-resin (Derris)	·82	
	Benzene Hexachloride	·1	
Kymac	Cresols	58·00	Younghusband Ltd., 94 King-street, Melbourne, and Elder Smith and Co. Ltd., Geelong
	Rotenone and allied substances ..	1·33	
Little's Liquid	Arsenic (As_2O_3)	12·20	Wilcox, Mofflin Ltd., 34 King-street, Melbourne
	Tar Acids	13·00	
" Fluid	Tar Acids	19·00	" " " " "
Quibell's Liquid	" "	18·00	Dalgety and Co. Ltd., 461–471 Bourke-street, Melbourne
Vallo Fluid	" "	18·00	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Young's Red Label Paste	Phenols	24·00	
	Arsenic (As_2O_3)	15·00	Strachan and Co. Ltd., Geelong
	Tubatoxins	19·50	
Osmond's Ivory Fluid	Tar Acids	18·00	Osmond and Sons (Aust.) Ltd., 35 William-street, Melbourne
Sickle Double Action	Arsenic (As_2O_3)	21·00	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
	Rotenone and allied substances ..	·70	
Quibell's Special Powder	Arsenic (As_2O_3)	21·60	Dalgety and Co. Ltd., 461–471 Bourke-street, Melbourne
	Rotenone and allied substances	·70	

LIST OF FUNGICIDES, ETC., ETC.—*continued.*

Distinguishing Name of Fungicide and/or Insecticide.	Percentage of Declared Active Constituent(s).	Wholesale Dealer.
***Miscellaneous Sheep and Cattle Dips*—continued.**		
Little's Supreme Powder ..	Arsenic (As_2O_3) .. .. 19·50 Rotenone and allied substances .. ·70	Wilcox, Mofflin Ltd., 34 King-street, Melbourne
Vallo Dual Purpose	Arsenic (As_2O_3) .. .. 21·00 Rotenone and allied substances .. ·70	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Hart's Immunol Jetol	Arsenic (As_2O_3) .. .. 24·50 Cresol .. .. 33·40 Derris Oleo-resin .. .. ·82	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Immunol Derris Cresol ..	Cresol .. .. .. 60·00 Derris Oleo-resin .. .. 1·50	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Allkon Derris Cresol	Cresol .. .. .. 60·00 Derris Oleo-resin .. .. 1·50	Allkon Pty. Ltd., 36 Clarendon-street, South Melbourne
Udip	Arsenic .. .. .. 23·00 Sulphur .. .. .. 73·00	D. G. Officer Pty. Ltd., 90 William-street, Melbourne
Vacdip Q	Arsenic (As_2O_3) .. .. 15·00 Total Phenols .. .. .. 7·00	Vacuum Oil Co. Pty. Ltd., 29 Market-street, Melbourne
Allkon Special	Arsenic .. .. .. 24·50 Cresol .. .. .. 33·40 Derris Oleo-resin .. .. ·82 Benzene Hexachloride .. .. ·1	Allkon Pty. Ltd., 36 Clarendon-street, South Melbourne
Elliott's 35 Liquid Dip ..	Arsenic (As_2O_3) .. .. 25·00 Rotenone and allied substances .. 1·00 Cresylic Acid .. .. .. 67·00	D. G. Officer Pty. Ltd., 90 William-street, Melbourne
,, 67 Liquid Dip	Polysulphide Sulphur .. .. 20·00	,, ,, ,, ,, ,, ,,
,, 94 Powder Dip ..	Arsenic (As_2O_3) .. .. 25·00 Rotenone .. .. .. 0·24	,, ,, ,, ,, ,, ,,
,, 128 Liquid Dip	Arsenic (As_2O_3) .. .. 64·00	,, ,, ,, ,, ,, ,,
,, 221 Liquid Dip ..	Rotenone and allied substances .. 2·50 Cresylic Acid .. .. .. 35·00	,, ,, ,, ,, ,, ,,
Vetamac No. 3	Arsenic (As_2O_3) .. .. 20·00 Cresylic Acid .. .. .. 8·00 D.D.T. .. .. .. 2·00	A. H. McDonald, 627 Bridge-road, Richmond
Vetamac	Arsenic (As_2O_3) .. .. 20·00 Cresylic Acid .. .. .. 8·0	,, ,, ,, ,, ,,
"D" Death Dip	Cresylic Acid .. .. .. 5·50 D.D.T. .. .. .. 6·00 Sulphur .. .. .. 5·00 Derris Oleo-resin .. .. 1·0	J. D. Harmsworth and Co. Pty. Ltd., 185 William-street, Melbourne
Young's Green Label	Phenols .. .. .. 31·0 Coal-Tar Hydrocarbons .. .. 20·5 Benzene Hexachloride .. .. ·9	Strachan and Co. Ltd., Geelong
Improved Border Paste	Benzene Hexachloride .. .. 6·0	Elder, Smith and Co. Ltd., Geelong Younghusband Ltd., 94 King-street, Melbourne
Quibell's Gamma	,, ... 6·0	Dalgety and Co. Ltd., 461 Bourke-street, Melbourne
Little's Numex	,, ... 6·0	Wilcox, Mofflin Ltd., 34 King-street, Melbourne
Sickle Gamalene	,, ... 3·5	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
Cooper's Gamatox	,, ... 6·0	New Zealand Loan and Mercantile Agency Co. Ltd., 538 Collins-street, Melbourne
United	Arsenic (As_2O_3) .. .. 40·0 Cresylic Acid .. .. .. 12·5	The Australian Estates Co. Ltd., 114 William-street, Melbourne
Gardovis	Eucalyptus Oil .. .. .. 20·0 Chlorinated Benzene .. .. 20·0 D.D.T. .. .. .. 12·0	W. K. Burnside Pty. Ltd., 34 Jeffcott-street, Melbourne
David Gray's D.D.T.	D.D.T. .. .. .. 20·0	Woodell Agencies Ltd., 578 Bourke-street, Melbourne

Weed Destroyers (Non-Poisonous).		%	
Atlacide C.A. Solution	Sodium and calcium chlorates	25·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
,, ,, Powder	Calcium chlorate	38·0	,, ,, ,, ,, ,, ,, ,,
Laykold Weed Killer	Sodium Rhodonate	12·0	W. B. Carr Constructions Pty. Ltd., Arden-street, North Melbourne
Ramtre	Sodium Chlorate	98·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Lawn Dinoc	Sodium dinitro-ortho-cresylate	30·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Hardy's 2.4.D. Powder	Sodium 2-4-dichlorophenoxyacetate	77·0	Hardy's Weed Killer, 422 Collins-street, Melbourne
Methoxone	Sodium 4-chloro-2-methyl-phenoxy-acetate	10·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Weedust	2-4-dichlorophenoxyacetic acid	2·0	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne
Weedone	,, ,, ,,	9·6	,, ,, ,, ,, ,, ,, ,, ,,
Weedust No. 5	,, ,, ,,	5·0	,, ,, ,, ,, ,, ,, ,, ,,
Weedone Concentrate 57	,, ,, ,,	35·2	,, ,, ,, ,, ,, ,, ,, ,,
Weedar 77	,, ,, ,,	41·0	,, ,, ,, ,, ,, ,, ,, ,,
Pixweed (2·4–D) Liquid	,, ,, ,,	10·0	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
,, Powder	,, ,, ,,	82·0	,, ,, ,, ,, ,, ,, ,, ,,
Hormex 5x	,, ,, ,,	50·0	Wilcox, Mofflin Ltd., 34 King-street, Melbourne
Vetamac S.2.4D	Sodium 2-4-dichlorophenoxy-acetate	4·0	A. H. McDonald and Co .Pty. Ltd., 627 Bridge-road, Richmond
Vallo 2·4–D	2-4-dichlorophenoxy-acetic acid	82·0	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
Kix	,, ,, ,,	16·3	Clark King and Co. Pty. Ltd., 237 Queen-street, Melbourne

Weed Destroyers (Poisonous).		%	
Hipple	Arsenic (As_4)	60·6	Horticultural Industries Pty. Ltd., 67 Burnley-street, Richmond
Weed-Nox*	,, ,,	64·8	,, ,, ,, ,, ,, ,, ,, ,,
Bell's Dandy Blue	,, ,,	55·0	Rocke, Tompsitt, and Co. Ltd., 292 Flinders-street, Melbourne
Cooper's Weedicide*	,, ,,	42·0	Ramsay and Treganowan Ltd., 475 Latrobe-street, Melbourne
Globe	,, ,,	59·0	Rocke, Tompsitt, and Co. Ltd., 292 Flinders-street, Melbourne
,, Weed and Scrub*	,, ,,	21·0	,, ,, ,, ,, ,, ,, ,, ,,
Vallo Weed, Scrub, and Tree	,, ,,	60·6	Victor Leggo and Farmers Ltd., 288 Williamstown-road, Yarraville
,, Arzeen	,, ,,	60·6	,, ,, ,, ,, ,, ,, ,, ,,
,, Liquid Arzeen*	,, ,,	65·4	,, ,, ,, ,, ,, ,, ,, ,,
,, ,, Pentoxide*	,, ,,	32·9	,, ,, ,, ,, ,, ,, ,, ,,
Hart's Soluble Arsenic Liquid*	,, ,,	64·0	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
,, Killaweed*	,, ,,	30·0	,, ,, ,, ,, ,, ,, ,,
B.A.C.*	,, ,,	20·0	W. B. Carr Construction Pty. Ltd., Arden-street, North Melbourne
Lion Weed Killer	,, ,,	60·6	Orchard Sprays Pty. Ltd., 549 Church-street, Richmond
Vetamac*	,, ,,	28·0	A. H. McDonald, 627 Bridge-road, Richmond
Nosco	,, ,,	60·6	Wm. Haughton and Co. Pty. Ltd., 545 Little Collins-street, Melbourne

* In liquid form (percentage weight in volume).

Note.—Wherever D.D.T. is mentioned in this list, the percentage shown is in terms of the para para isomer of dichloro-diphenyl-trichloroethane. Similarly, Benzene Hexachloride is shown in terms of the gamma isomer.

Melbourne, 4th April, 1949.

W. R. JEWELL, M.Sc., F.R.I.C.,
Chemist for Agriculture.

CERTIFIED PULLORUM-TESTED FLOCKS (POULTRY)

A certified Pullorum-Tested Flock is one in which all stock over six months of age have given a negative reaction to the agglutination test for Pullorum Disease, and in which all such stock are kept under rigid conditions of isolation approved by the Chief Veterinary Inspector.

The undermentioned flocks have been certified by the Department of Agriculture, and will remain so for the current calendar year, or until such time as the Chief Veterinary Inspector determines.

Application forms are obtainable from the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

Particulars of breeds of birds tested are as shown hereunder:—

A. Australorp; B. White Leghorn; C. Rhode Island Red; D. Sussex; E. Langshan; F. Brown Leghorn; G. Buff Orphington; H. Black Leghorn; I. Minorca; J. Ancona; K. Legbar; L Indian Game.

Owner.	Breed.	Number of Birds.
Anguey, H., 138 Hargreaves-street, Castlemaine	A, B	725
Baker, J., Greensborough	A	1,077
Barastoc Experimental Farm (G. Lee Manager), Croydon	A, B, C	716
Bayfield, A. E., Seven Acres Poultry Farm, Springvale	B, C	1,374
Bingley, A., 333 Highbury-road, Burwood	A, B	2,108
Bishop, Mrs. P. M., Springvale-road, Springvale	A, B, C	1,810
Bray, J., 18 Hotham-street, Warrnambool	B	140
Burney and Pound, North-road, Langwarrin	A, B	1,731
Cashin's Poultry Farm, 2 Dawson-street, Stawell	A, B	2,528
Chalmers, H. L., 9 Lefevre-street, Spotswood	B, F, K	582
Chamberlain, L., Nathalia	A, B	1,984
Chapman, Mrs. E., Youanmite	A, C	282
Collins, A. J., Emerald	A, C	354
Colquhoun, Dr. W. L., "Aringa", Ringwood	A, B	195
Corbett Bros., Torbay-street, Macleod	A	2,318
Davies, L. F., Westall-road, Springvale	A, C	1,368
Davis, N. W., Mickleham, via Broadmeadows	A, B	3,089
Emmott, J. T., Verdon-street, Inglewood	A, B	293
Fletcher, J. H., "Homeleigh," Tallygaroopna	B	1,621
Ford, J. V., 11 Barkers-avenue, Shepparton	A, B, C	1,026
Frye, I. H., Grimshaw-street, Watsonia	A, B	1,937
Gedye Bros., Railway-road, Blackburn	A, B	3,775
Gibbs, A. E., Stanhope	A, B	3,734
Grenville Poultry Farm, Springvale-road, Springvale	A, B, C	3,666
Guy, J., "Murlea" Murgheboluc	A, B, C	670
Gwyther, R. P., "Woorrayl", Highton	A, B	1,144
Hanson, S., Kilmore	A	237
Harrington, G. W., Springvale-road, Tally Ho	B	1,836
Harrington, W. H., Woodward-street, Golden Square	A	1,597
Hayes Bros., Mount Dandenong-road, Montrose	A, B	3,564
Henderson, C. W., Shepparton	A	395
Hewett, A. T., Central-avenue, Croydon	A, B	866
Hopkins, C. A. and Sons, Success Poultry Farm, Knight-street, Shepparton	A, B	1,656
Ikin, E. J., 44 McKay-street, Seddon	C	86
Inglis, W. J., Cobham-road, Mitcham	A, B	530
Jackson, Miss E. M., 4 Monash-street, Box Hill	B	48
Kay, V., 12 Wellington-street, Blackburn	A, B	2,634
Kennedy, F., Ferntree Gully-road, Glen Waverley	A, B, C	677
Lattimore, A. G., Kilsyth	A, B, C	817
Lintermans, W. A. J., Major-road, Lysterfield	C	1,160
Lonie, R. A., 1 Chanak-street, East Malvern	A, B, C	37
Magnusson, L., Nathalia	B	936
Maher, A. E., Wal Wal	A, B	765
Major, C. D., Simpsons-road, Eaglehawk	A, B	2,000
Marshman, A. R., Archie's Creek	A, B, C	767
McCabe, R., Gladstone-road, Dandenong	A, B, D	2,079
McCann and Sons, Crowlands-road, Stawell	B	4,198
McEwan, A. W. H., Whitehorse-road, Ringwood	A, B, K	157
McLaren, A. G., Mooroopna	A, B, C	979
McLauchlan, D. F., Rossiter-road, Koo-wee-rup	A, B	2,500
McTighe, C. H., Nar-Nar-Goon	A	571
McVay, A., Kernot-street, West Spotswood	A, B	2,506
Mills, J. J., Kelvinside-road, Noble Park	C	267
Mold Bros., Banbury Park Poultry Farm, Old Narre Warren-road, Emerald	A, B	1,141
Molsons White Leghorn Stud (G. Durkin, Man), 188 Surrey-road, Blackburn	B	1,311
Moran, S. G., Glenburnie-road, Mitcham	A, B	732
Moroney, J. B., Kangaroo Flat	B	1,150
Neal, J. H., 18 Watt-street, Spotswood	L	22
Niewand, F. J., "Kalang," Lubeck	A, B, C	1,275
O'Brien, R. J., Watson-road, Glen Waverley	A, C	694
Rae, J., Albert-street, Sebastopol	B, C	1,889
Ridge and Son, 43 Myrtle-grove, Blackburn	A, B, C	3,045
Robinson, W., 11 Olive-street, Hampton	B, C	1,029
Rose, H., Yarrambat	B	583
Rowe, Mrs. L. M., "The Wattles," Wal Wal	A, B	319
Salmond, J. B., Deer Park	H	246
Scales, J., West Wattle Tree-road, Boronia	A	1,492
Settle, J. H., Stanhope	A, C	2,491
Simpson, G. D., May-road, Glen Waverley	B	2,928
Smith, H. A., Marong-road, Maiden Gully	A, B, C	1,196
State Research Farm, Werribee	A, B	2,062
Stewart, J., Maldon-road, Castlemaine	A, B	565
Swift, D. A., Kangaroo Flat	A, B	2,313
Taylor, R. H., 132 Rathgowan-road, Reservoir	A, B, C	3,730
Walton, F. R., Woodvale-road, Boronia	A, C	707
Welch, T. A., Bayswater-road, Croydon	A, B	3,062
Wesley, J. H., "Fairview", Kangaroo Flat	A, B, C	1,210
Winter, G. A., "Denehurst" Murgheboluc	A, C	355

Burn Orchard Prunings

Winter sprays are more effective when applied as near as possible to bud-burst, which means that, in many cases, pruning will have been carried out before the trees have been sprayed. Many of these unsprayed prunings will be infested with the eggs or larvae of overwintering pests. It is essential, therefore, as an additional control measure, to collect all prunings and burn them.

[Contributed by the Horticultural Division.]

BERRY FRUITS IN ENGLAND AND AMERICA

Observations made by Frank M. Read, M.Agr.Sc., Chief Inspector of Horticulture, during a visit to England, Canada and the United States in 1948.

The berry fruit industries in Victoria during the past 30 to 40 years have declined, mainly because of virus diseases which, for a long time, were not recognized as such. This is particularly so in the case of strawberries, where we have not only lost acreage, but better-quality varieties have disappeared to be replaced by fruits of lower quality which are more tolerant of the viruses.

Raspberries have almost disappeared from the horticultural scene, their place being taken, as far as it was possible to do so, by loganberries. While economic factors and fungal root rots have greatly contributed to the decline, low yield coming from reduced vigour in the plants, due to virus attack, was the prime cause in many cases.

The position in England and America is much the same with respect to virus troubles in their strawberries and brambles with the addition of a new virus "Dwarf" of loganberries and raspberries, and Red Stele of strawberries, a fungous disease of great importance in those countries. The result is that a great deal of work is going on overseas from which we, in this State, can profit greatly.

STRAWBERRY VIRUS DISEASES

Immediately following the first World War, high-grade strawberry varieties in Great Britain, such as Royal Sovereign and Sir Joseph Paxton, rapidly degenerated and were gradually replaced by Huxley's Giant, which now produces the bulk of England's strawberries, Madam Lefebvre, and some other varieties.

By 1947, at least three virus complexes had been recognized. Virus 1 is the cause of mild crinkle, and is picked up by the strawberry aphid, *Capitophorus fragariae*, its vector, on a short feeding period and does not generally persist in the aphid for more than three hours.

Viruses 2 and 3 are picked up from "yellow edge" and severe crinkle plants, respectively, only on prolonged feeding by the aphid, but persist in its body for a much longer time. Virus 2 by itself causes very mild symptoms of yellow edge. Virus 3 by itself causes moderately severe crinkle. Virus 2 and virus 1 together produce severe yellow edge. Virus 2 and virus 3 together cause severest yellow-edge symptoms. Virus 3 and virus 1 together cause the severest crinkle. Thus, the virus position is very complex. More recently it has been suggested that virus 2 itself is a complex of two viruses, while a fourth virus common in commercial stocks, but at present of uncertain importance, has been isolated. A fifth virus has been isolated in England from a plant of American origin.

Dr. R. V. Harris describes these new viruses in the following, as yet unpublished, terms:—

"Virus 4, probably including more than one component in the "persistent" group hardly shows on *F. vesca* at all, but produces severe vein clearing or vein necrosis symptoms on Royal Sovereign. It is probably implicated in the severer manifestations of Crinkle and Yellow-edge.

Virus 5 has only been found naturally occurring on varieties Premier and Fairfax imported from America. It has low persistence in vector and produces drastic 'shock' symptoms on *F. vesca* (leaf down curling) which later become mild, and on Royal Sovereign no symptoms at all."

Dr. Harris would be most interested to hear if we have any reason to suspect that these viruses may be present in Australian stocks.

No wild or cultivated strawberry is known to be immune to all these viruses. "The only approximation to sustained and complete tolerance to all known viruses so far discovered is a strain of the

parent species of the European cultivated strawberry hybrid, *Fragaria chiloensis*—the American "Beach strawberry."*

Certification of Strawberries

Tolerant varieties, like Huxley's Giant, are thought to be able to tolerate up to two viruses, but degenerate if more than two are present, while more sensitive varieties, such as Royal Sovereign, may show obvious symptoms only if more than one virus is present.

Thus, the certification of a plant as being absolutely free from virus cannot be based on visual symptoms alone. It is necessary to graft the commercial variety on to highly-sensitive indicator plants such as the woodland strawberry—*Fragaria vesca*, which shows symptoms even if only one virus is present. Royal Sovereign in England and Marshall in the United States, two very sensitive commercial varieties, are also used as indicator plants. Such grafting work can be carried out only under carefully-controlled conditions and only for special experimental or isolation purposes. It is not, of course, a normal practice in field certification.

Nevertheless, certification of strawberry runners for sale in England is compulsory, and is proving beneficial in distributing plants which retain vigour for, say, three to four years. For the compulsory "Strawberry A" certificate, parents and runners are inspected in September—early autumn—and plantations are not certified where more than a small proportion of the plants show clear virus symptoms.

A "special stock" certificate for strawberry runners was introduced in 1945. This is voluntary, and the conditions are much more rigorous than those described above so that only growers who can make runner-raising a specialty are likely to apply for the "special stock" certificate. The conditions are set out in the Annual Report of the East Malling Research Station, published in October, 1948.

The principal objective of strawberry certification in England appears to be to obtain healthy plants of the variety Royal Sovereign because of its outstanding quality and general performance in the years prior to the onset of virus degeneration.

* A Review of Some Recent Research on Virus Disease of Raspberries and Strawberries in Great Britain. R. V. Harris, Proceedings of the Royal Philosophical Society at Glasgow, 1947. Vol. LXXI., Part 5.

The East Malling Research Station some years ago put out Malling 40, a virus-free clone of Royal Sovereign which was bulked up under "special stock" certification conditions and has gone into commercial use.

On what I was able to see it appears that Malling 40 plants retained their vigour under commercial conditions for about three years, although I saw one patch still quite vigorous in its fifth year. During this time a yield of 2½ tons per acre would be thought satisfactory. In addition, a new tested clone of the variety Perle de Prague, syn. Malling 45, was distributed to "special stock" nurseries in a limited way in 1947. This variety, like Huxley, is capable of yielding over 4 tons per acre, but of better-quality fruit. It is a vigorous early-ripening variety. Under field conditions such clones slowly become re-infected with virus, despite all certification precautions and from time to time it will be necessary for fresh issues of virus-free material of these tested clones to be made by the Station to the trade.

Strawberry Breeding

The East Malling Station is also breeding for virus-sensitive varieties of high quality and has under trial several new selected clones of Royal Sovereign and Paxton.

At the Cambridge Horticultural Research Station, Mr. D. Boyes has, for many years, been breeding strawberries, and, in recent times, has handed over to a commercial nurseryman in Hampshire about 40 varieties. Unfortunately, time did not permit me to visit this nursery; but, at Wisbech, I saw trial crops of six of these varieties chosen by the grower which appeared to be progressing satisfactorily towards the end of their first year. I spent some time with Boyes at the breeding station where the work is continuing, and where there are, unquestionably, many strawberries reaching the stage of liberation which have vigorous plants and good crops of large high-quality and good-coloured fruit. I would like the opportunity of observing them under Victorian conditions. No special breeding for virus or fungus tolerance has been practised, desirable plant and fruit characters being this breeder's objective. Since, however, weak plants and irregular clones have always been rejected, it is probable that these straw-

berries are rather virus tolerant like the strawberries in principal use in Great Britain commercially.

One of the many attractive and vigorous new strawberry varieties bred by Mr. D. Boyes at the Horticultural Research Station, Cambridge. The round object, left, is 1½ inch in diameter.

Breeding versus Certification

There is a cleavage of opinion in Great Britain on the way to handle the virus problem.

On the one hand are those who say that virus-tolerant varieties, like Huxley, even though in that case of quite poor quality, have steadily increased because of their higher yield at the expense of the higher-quality, virus-sensitive sorts like Royal Sovereign. Their idea is to breed tolerants of higher quality, the propagation of which would not necessitate special control measures.

On the other hand, there are those who believe that, since there is no known source of immunity on which a breeding programme could be based, and since even tolerants degenerate when they have acquired a sufficient number of viruses, it would be better to base strawberry production on virus-sensitive varieties which would more quickly disclose the presence of virus and enable sound certification schemes to cover the production of runners. To them the distribution of tolerant varieties in the strawberry-growing districts is undesirable because, though apparently healthy, the tolerant plants will almost certainly carry at least one virus and so accelerate infection and degeneration of nearby specially-selected sensitives.

The view of leading American authorities on this matter was that, on technical grounds, the controlled propagation of healthy virus sensitives may be preferable, but, from a practical point of view, it was not possible at present to satisfy strawberry-growing requirements in this way, and, consequently, the use of virus-tolerant varieties was likely to continue, especially if they were of high quality.

Dr. G. M. Darrow, of the United States Department of Agriculture, said that the strawberry virus problem had been somewhat reduced by the introduction of DDT, Parathion, and other aphicides, and there is hope of cleaning up strawberry stocks with the aid of such products.

Strawberry work in U.S.A.

In the strawberry glasshouse at Beltsville, Dr. Darrow showed me two strawberry viruses outside the yellow-crinkle complex. One, a Wisconsin virus, also present in Oregon, produces a plant with many small crowns giving a witches'-broom effect. This is easily rogued out. The other is a virus in which the leaves are cupped and papery though dark green. This latter virus, known in Oregon as "stunt", is widespread, but does not do much damage. It is being observed in case it flares up and is probably transmitted from a weed alternative host.

Potentella, the next genus to *Fragaria* is being tested against Marshall strawberry for virus with a view to its possible use in breeding for virus resistance. Dr. J. B. Demaree is working on virus resistance at the Beltsville Station, U.S.D.A., and is likely soon to publish a new paper on virus in eastern U.S.A. strawberries.

Dr. George Waldo, in Oregon, is breeding virus-tolerant plants and hopes to use *Fragaria chiloensis*, *Fragaria ovalis* (the hill strawberry), and *Fragaria virginiana* (an eastern wild strawberry) in a search for virus resistance. He selects,

in an insect-proof glass-house, virus-free individuals tested against indicator plants by grafting. He dips these plants in Parathion, a very efficient new aphicide, prior to planting in the field as individual plants in the first year. Each plant is allowed to fruit for one year in the field. If the plant is good the fruit cluster and habit are examined. If that is good, then the fruit is examined, and, if the fruit is of high quality, the plant is saved for further work. From the one plant Dr. Waldo usually obtains next year, enough runners to put out a 50-ft. row for trial with plants spaced 2 feet apart. These plants produce runners on either side to fill up the row and then are permitted to fruit. The 50-ft. row gives a record of yield and fruit size with some reliability If the 50-ft. row test is satisfactory, plants can then go to other places in Oregon for further trial.

Dr. Waldo is commencing to breed strawberries more suited to quick freezing, and hopes to get virus-free Royal Sovereign from England for use in this work.

In California, strawberry breeding by the University of California has produced five varieties of interest. These are virus-tolerants, no immune variety having been discovered. The Californian authorities believe it to be impossible to certify in the field free of all virus components and, therefore, prefer the use of tolerants, though they still have them propagated in special isolated nursery areas for commercial production. These isolated spots are in the interior where the warm climate does not favour the spread of virus.

Lassen is the variety most tolerant to virus and much the best for tolerance to yellow edge; the fruit, however, is not of good quality.

Shasta is the most popular of the five. Not quite as yellow-edge tolerant as Lassen it is better for sustained production through the spring and autumn and has a better fruit. It can go three to four years in the commercial field as compared with Lassen four to five years.

Sierra, Donner, and Tahoe are popular in that order with growers. All five of these would be interesting to try in Victoria, but Shasta would appear to be the most desirable for all-round purposes.

STRAWBERRY RED CORE ROOT-ROT

The virus-induced degeneration of strawberries in Scotland and parts of England was, for many years, obscured by the even more serious attacks of a fungous disease variously known as Lanarkshire disease or strawberry red-core root-rot, due to the fungus *Phytophthora fragariae*. It has become a major disease also in U.S.A. and Canada since its discovery in 1932. It is not known as a commercial problem in Victoria.

Strawberry breeding by Dr. G. Waldo, Oregon. Single plant selections in foreground and at rear, fifty-foot trial rows.

Mr. R. D. Reid, at Auchincruive in Scotland, has bred a number of varieties which are resistant to red core. Of the Auchincruive seedlings, possibly Auchincruive Climax is the most used, but several are of major interest in Great Britain at the present time.

At the Wisley National Fruit Trials, Climax and No. 10 seemed the most favoured, while, at the Cornwall Experiment Station at Ellbridge, Auchincruive 6 was preferred as an early variety suited to that district. They are also of interest to American strawberry

workers. In fact, I gathered the impression that there is more work going on in Great Britain and North America on red core than on virus because of its seriousness and possibly also because breeders have been able to forsee good results against *Phytophthora*, while, in the absence of any source of real immunity to virus, they are not yet confident in that field. I learned in America from Dr. Darrow that the Auchincruive varieties did not stand up against Red Stele when tried by the U.S. Department of Agriculture at the Beltsville Station, either because the American strain of the fungus is different from the British or because the conditions of the test were much more rigorous.

Thinning out "runners" from first-year Huxley's Giant strawberries at Wisbech, England.

At Beltsville, new varieties are tested in the greenhouse by growing in infected soil which is kept continually damp and at a temperature of 50°–55° F. Such a cool temperature with soil saturated for two to three hours at a time is necessary for the swimming stage of the organism to infect the plant. High temperatures later in its development favour the *Phytophthora*. Nevertheless, in practice, the Auchincruive seedlings are quite resistant in the field, and some of them are somewhat tolerant to virus. We should certainly try to obtain a range of them for observation in Victoria.

In eastern U.S.A., strawberry varieties U.S.D.A. 3374 and Maryland 683 are almost immune to Red Stele, while the variety, Aberdeen, is resistant in the field, although not in the greenhouse. The variety, Temple, widely used commercially for Red Stele resistance, has shown some susceptibility in the field under wetter seasonal conditions in the last few years. The variety, Fairland, a cross between Aberdeen and Fairfax, was released by the U.S.D.A. late in 1947. It is an early variety resistant to Red Stele root-rot and recommended for planting in eastern U.S.A. for local market fruit in preference to the widely-planted Howard 17 (Premier).

In Oregon, I saw "Black Root" of strawberry, the root having a normal centre or stele, but a black outer layer or cortex. The cause of Black Root has not been found, but it occurs in the same proportions as Red Stele, and conditions which eliminate the one also eliminate the other. It is possible that they are related.

RASPBERRY VIRUS DISEASES

Raspberries declined in Great Britain after World War 1, the then popular varieties failing in vigour and in yield to be almost universally replaced during the late 1920's by the then recently-introduced vigorous Lloyd George variety. Lloyd George remained vigorous until the late 1930's, by which time it had replaced most other varieties. It had given 2 to 3 tons per acre. Then it commenced to decline in vigour, and yield fell to 15 cwt. per acre. Thus, towards the end of the war, raspberry growing in Great Britain was at a very low ebb.

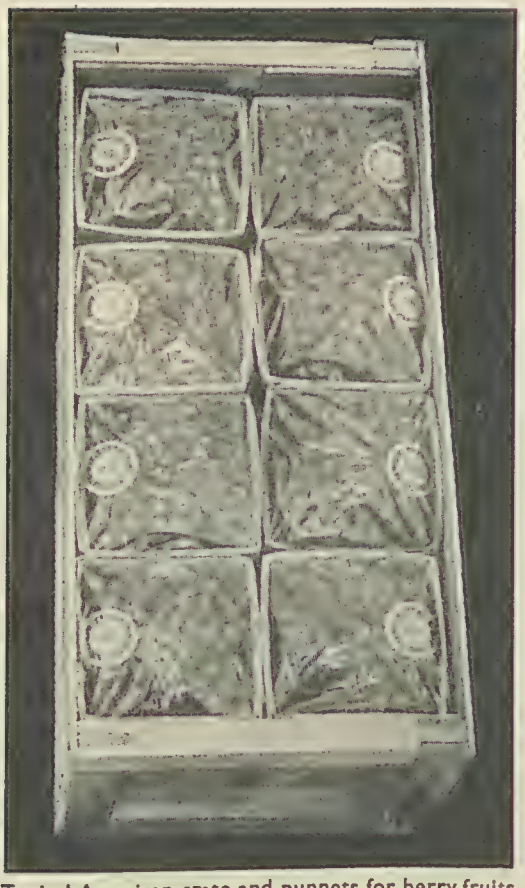
From a considerable amount of research work undertaken, it is now evident that the raspberry virus position is much more complicated even than that described for strawberries. At least ten viruses recognizable by visual symptoms on indicator plants have been identified, and the aphids *Amphorophora rubi*, Kalt. and *Aphis idaei V. d. G.* established as vectors of raspberry viruses.

To the present, however, it has not been practicable to make it compulsory for raspberry plants grown for sale to carry Government certification. There is, however, a "Special Stock" certificate for raspberries which is voluntary. The conditions for the granting of this "Special Stock" certificate appear in the Annual Report of the East Malling Research Station published in 1947.

Raspberry viruses spread from one plantation to another more slowly than strawberry viruses and a distance of 50 feet is accepted as sufficient isolation for virus-sensitive varieties, though a greater distance is necessary for the separation of tolerant varieties under certification from other raspberry plants.

In raspberries, as distinct from strawberries, a virus producing a particular symptom on one variety may produce, when transmitted to another variety, quite distinct symptoms, or no symptoms at all. For instance, Lloyd George shows no diagnostic leaf symptom for Mosaic 2, though the general vitality of the variety is adversely affected.

Similarly, several other so far unidentified raspberry viruses cause degeneration or lowering of vigour in raspberry plants without any distinct symptoms. The task of identifying raspberry virus, therefore, by graft and insect transmission to the several indicator plants is a difficult one.



Typical American crate and punnets for berry fruits. Only blueberries are cellophane covered.

It may be further complicated by the effect of climatic conditions. For instance, the leaf-curl virus symptom is very much worse in Scotland than it is in the south of England. Approach grafts made from diseased to healthy indicator plants in Scotland and then sent to the East Malling Research Station in Kent did not behave normally at all, though duplicates followed the usual course when left in Scotland. The virus under unfavorable climatic conditions may be outgrown in the plant by other tissues and may be quite absent from the tips of canes from which it is then possible to propagate virus-free plants.

Despite the complexity of the problem, considerable progress is being made jointly by Dr. R. V. Harris and Dr. C. H. Cadman and their associates, who are endeavouring to discover which combinations of the viruses are responsible for the degeneration of particular commercial varieties, especially tolerant varieties such as Lloyd George and Malling Promise. For this work it was desirable to have virus-free plants of Lloyd George, and a search was made in Great Britain without success. Even the Amos Lloyd George which had been propagated in isolation by Mr. Arthur Amos, of Wye, and which appeared vigorous and virus-free, was found to be widely infected with Mosaic 2 when grafted to Baumforth's B. as an indicator plant.

New Zealand as source of healthy stock

A discovery of highest importance was that Lloyd George raspberry plants introduced into England from New Zealand in 1946 were quite free of virus and were of value not only as test plants in the unravelling of the virus complex, but also as a source from which this variety could again be propagated on a large scale for commercial planting. The New Zealand Lloyd George is being bulked up in Scotland in isolation, and a five-year plan is envisaged to ensure a continuous flow to the industry of healthy stock. It appears that the known American and European vectors of raspberry viruses do not occur in New Zealand, and, though some plants show mild virus infection, presumably coming from virus on original introductions carried on by vegetative propagation, the building up of serious virus complexes in raspberry plants does not occur in New Zealand in the absence of insect vectors.

Picking raspberries at Ellbridge Horticultural Research Station, Cornwall.

The English workers, therefore, consider that New Zealand could easily rogue out virus diseases and propagate under favorable conditions virus-free nursery material for export. Victorian growers will be interested to know that, according to British workers, varieties which used to be well-known in Victoria, such as Red Antwerp, Great American, Fillbasket, and Superlative, as well as Lloyd George, are thriving and could, presumably, provide a source of healthy planting stock. It seems quite possible that, if such healthy material could be obtained from New Zealand and be grown in situations reasonably isolated from other brambles, especially if the plants were sprayed with such modern aphicides as DDT and Parathion, we could, in Victoria, re-establish our raspberry industry.

A NEW SERIOUS VIRUS DISEASE

"Dwarf" disease of blackberries, loganberries, and raspberries is a most serious virus disease, possibly quite outside the Leaf Curl-Mosaic complex, to which reference has been made above. Prior to 1946, Dwarf had been restricted in Great Britain to the blackberry and Phenomenal berry, but, in that year, it was reported on loganberry, and, during 1947, on raspberry. Since that time it has played havoc with loganberry plantations, and has spread rapidly among raspberries. It causes a general dwarfing of the plant, a yellowish-green colour of the leaves and an unusually stiff and erect growth of canes and laterals. In the second or subsequent year of visual symptoms, it causes the dying out of plants. The vector of this disease is not known. It has a long incubation period of probably two years between infection and the appearance of symptoms which makes it difficult or even impossible to ensure that a plantation is free from Dwarf. In certification schemes in England, there is no tolerance whatever allowed for this disease. It occurs also in North America, and, in view of the seriousness with which it is viewed by English workers and the industry, it would be most undesirable, until the position is thoroughly examined, for introduction of plants of any of the above classes into Australia from those countries. So far in Victoria, we know nothing of this disease.

RASPBERRY VARIETIES IN ENGLAND

Malling Promise

Malling Promise is the outstanding variety being grown in England commercially to-day. Wherever I saw it, it was vigorous and

yielding crops of large and good-quality fruit, but, in places, its branching habit made it a little difficult to control. It was bred by Mr. N. H. Grubb, of the East Malling Research Station, and is both tolerant and fairly resistant to infection by virus. It is normally planted in rows 8 feet apart with 2 feet between the plants. Its season is early.

Norfolk Giant

This raspberry has been used considerably as a variety which retains its vigour and yield. It is sensitive to virus when infected, but is said to owe its field vigour to a high degree of resistance to infection. Its fruit, however, is of very poor quality and suitable only for jam. It is the latest variety to ripen.

Newburgh

An American mid-season variety, Newburgh is very tolerant to virus, has a good cane habit, and good-quality fruit. It is one of the parents of Malling Promise.

M. Landmark and M. Enterprise

East Malling Research Station has also developed to the stage of commercial liberation a number of other varieties bred by Grubb and described by him in the report of the East Malling Research Station for 1942, and again by Painter in the East Malling Annual Report published in October 1948. Of these *Malling Landmark* is the heaviest cropper of all in the yield trials at East Malling. It is very vigorous, but the fruit quality is not good, usually too soft for anything but jam. It is not quite as late as Norfolk Giant.

A mid-season variety, *Malling Enterprise* is very vigorous, though rather spreading in habit. Fruit is very large, round, and firm with bright colour, though not quite as bright as Lloyd George. I thought it, perhaps, the most likely variety to meet Victorian requirements.

For the present, in view of the danger of introducing Dwarf, we should not introduce these varieties for trial, but Mr. Grubb kindly agreed to again cross the parent varieties which had yielded these new seedlings so that we could, in Victoria, grow the seed and select from the range of seedlings produced individual plants suited to our conditions to be subsequently vegetatively propagated.

GROWING RASPBERRIES FROM SEED

At the John Innes Horticultural Research Station, a quite different attack on the problem of raspberry degeneration is being investigated. Many virus diseases, including those of the raspberry, are not transmitted through the seed; thus, seedling plants would originally be free of virus while all vegetatively-propagated plants would carry the viruses present in their parent.

The trouble with seedlings normally would be that characteristics such as fruit colour and size and flavour and time of ripening and vigour of the plant would be so variable from plant to plant that one could not produce raspberries commercially by this means. John Innes is endeavouring to overcome this variability in seedlings by the selection of pairs of parents which, when crossed, will give seedlings fairly uniform in the characteristics of commercial importance such as those suggested above, though, from plant to plant, there may be variation in other characteristics. I saw trial rows of raspberries raised from seed which were, to say the least, very promising, the crop of all plants ripening at about the same season and having sufficiently uniform characteristics and quality to be used for processing, even though some difference in shape of fruit would make it relatively less suitable for sale as fresh fruit in punnets. There is the distinct possibility, too, that such hybrid seedlings will carry the advantages in growth and yield which, in maize and other crops, come from the use of special lines of hybrid seed.

The three methods of producing hybrid raspberry seed are set out in the Thirty-eighth Annual Report of the John Innes Horticultural Institution published March, 1948.

RASPBERRY PROBLEMS IN AMERICA

In America, my opportunities for observing raspberries were limited, but, from discussions with authoritative people, I learned that the virus situation is similar to that in England, though in some States not as severe. The virus, Dwarf, has been known on blackberries for a considerable time and has frequently spread to raspberries, loganberries, and other commercial trailing berries. The recent popular

hybrid berries, Boysenberry and Youngberry, both carry Dwarf, though they are quite tolerant to it.

There has been for many years a great interest in the breeding of autumn fruiting or the so-called everbearing raspberries, and it would seem that the Lloyd George variety has been outstanding as a parent in transmitting the autumn fruit character. I was told by Dr. A. W. S. Hunter, of Ottawa Central Experiment Station, that in north-eastern United States and eastern Canada, Lloyd George x Newman 23, an American variety, is one of the best combinations of parents for breeding work, together with Viking, a high quality and vigorous variety developed at the Vineland Research Station.

In Oregon, Lloyd George x Viking had been a most productive cross where the aim has been to produce virus-tolerant varieties which are both everbearing and of high quality suited for canning and frozen pack. Cuthbert and Newburgh have also given very good results when crossed with Lloyd George.

I was unable to go to North Carolina, but should have been interested to see the raspberry breeding work of Dr. C. F. Williams at the Raleigh Agricultural Experiment Station. I learned at Beltsville, from Dr. Darrow, that Williams is crossing Southern Asiatic species with American varieties, such as Newburgh, in the hope that it will be possible to extend raspberry growing further south into warmer and more humid latitudes. We will be interested in Australia to see the outcome of this work. I regret, too, that I could not visit Dr. C. D. Schwartze, Puyallup, nor spend some time with Dr. G. L. Slate at Geneva. The work of these two leading authorities should be examined by anyone interested in raspberry and other small fruit breeding.

In view of the presence of Dwarf and the probability that we may not wish to run the risk of importing varieties from America, seed from such crosses would be of great interest and, as with Mr. Grubb in England, the workers I met thought it might be quite practicable for them to carry out some of these most promising crosses for us and send us the resulting seed from which we might select plants best suited to our conditions.

The thornless form of the Evergreen blackberry is one of the most popular berries for commercial planting in Oregon.

BLACKBERRIES

There is considerable interest in blackberries in Europe and America. While most of these are selections from the innumerable wild types and their naturally-occurring hybrids, an increasing interest by plant breeders is discernible, particularly in America. Perhaps one of the reasons why blackberries have not been given more attention in Victoria is their abundance as wildlings, but the excellence of the fruit of many of the new hybrids is commencing to have its effect. In flavour, of course, many of the wild blackberries are unsurpassed and are really the source of flavour for breeding work.

In England, Himalaya Giant is still the standard of quality, but there is considerable interest in Merton Thornless, a variety bred at John Innes. It is not quite regular enough in bearing yet, and further breeding work is being done. At John Innes I saw also Merton Early, a selected tetraploid wild blackberry of good fruit quality and

thorns that are not very stiff. The loganberry has also been widely planted in England, though it has been badly damaged by Dwarf in the last two years. I saw a thornless strain of Logan which retains all the other characteristics of the variety.

In the United States, many varieties have been grown commercially during the past 50 years, and, since the war, interest seems to be rapidly increasing because of the firmness of fruit of some varieties enabling them to be carried long distances to market. Again, for quick freezing and processing, blackberries are in demand.

In Oregon, Boysenberries, Youngberries, Loganberries, and the Evergreen Blackberry occupy the bulk of the acreage devoted to trailing berries. Of these the Boysen is the largest fruit and somewhat firmer than Logan. The Youngberry is a little smaller in fruit than Boysen, though larger than Logan with a milder and less acid flavour than Boysen. However, it seems to be losing ground to the Boysenberry. The Evergreen Blackberry, a selection of the Cut Leaf blackberry of England, is now the most favoured of the four for processing. For quick freeze it is preferred to the former three, and its berries can be carried satisfactorily to markets on the opposite side of the Continent.

New Oregon Varieties

In each of the above four cases, *thornless forms* have been evolved and are now being widely planted. Thornlessness is especially valuable in the case of the Evergreen Blackberry, but is also of considerable advantage in the other three berries where the thorns are not so objectionable. Thus, considerable importance is attached to development of these thornless forms.

In the case of Boysenberry, the thornless form has a somewhat smaller fruit and is not readily distinguishable from the thornless Youngberry, but the thornless forms of Young, Logan, and Evergreen Blackberry retain all the other characters of the plant and are not generally lower yielding than the thorny forms.

It is interesting to note that these thornless forms are periclinal chimeras so that, while shoots arising from the above-ground parts of the plant are thornless, any arising from the roots carry thorns. Propagation must, therefore, be from the tips of the canes and never from suckers.

The Merton thornless blackberry.

Dr. Waldo, in Oregon, is doing notable breeding work in these fruits and has recently bred from an octaploid Californian wild blackberry crossed by a tetraploid red raspberry La France, fruits of the Logan type, thus confirming the statements of Judge Logan, its originator, that Logan resulted from a cross between a wild blackberry and a raspberry, probably Red Antwerp. Further work is to involve the crossing of octaploid blackberries with autotetraploids of the leading raspberries in Oregon-Washington, Latham, and Willamette.

Cascade and Pacific are two new hybrids resulting from the cross Zielinski (a native-trailing blackberry) by Logan. The fruits have the characteristic blackberry flavour. Cascade is a slightly more vigorous plant, but Pacific fruit is slightly larger and firmer.

Pacific x Boysenberry has given an un-named variety 743, which has the largest berries ever seen

A row of high-bush blueberries with young high-bush x low-bush hybrids in front, the work of Mr. Stanley Johnston, Southhaven Experiment Station, Michigan.

in such brambles. Twenty berries weigh 150 grms. The plant, however, lacks vigour. Sufficient has been said to indicate that there is a profitable field in breeding better blackberries and blackberry-raspberry hybrids.

BLACK CURRANTS

In England, the black currant is a major fruit crop, about half of which is devoted to juice production. Because of its high vitamin C content, and the great popularity of black currant flavour, the demand for this juice is rapidly growing, and, in the new crosses now under test in England, particularly at the Long Ashton Research Station and the Wisley Trial Grounds, the vitamin C content is regarded as a most important point.

It will probably be a year or so before the crop of new post-war varieties can be reliably judged from this point of view.

Baldwin, one of the main varieties grown now, is the highest in vitamin C. I was told that, for juice production, a long-harvesting season is desirable, and a search for late varieties to extend the season is going on. The main black currant varieties in England now are :—

Boskoop Giant (Early).
Mendip Cross (Early).
Seabrook's Black (Second early).
Wellington XXX (Second early).
Baldwin (Mid-season to late).
Cotswold Cross (Mid-season to late).
Westwick Choice (Mid-season to late).
Daniel's September (Late).
Malvern Cross (Late).

Mr. Spinks, Plant Breeder of the Long Ashton Experiment Station, said he would be pleased to assist us in the selection of material to be sent out for trial. In view of the doubtful accuracy of Australian nomenclature in black currants at present, his assistance in this regard would be most helpful.

Interest in red currants is limited compared with black currants, but the best varieties in England now seem to be :—

Fay's Prolific.—The standard early variety.

Laxton's No. 1.—A new early variety which has been outstanding in trials.

Wilson's Long Bunch.—A standard mid-season to late variety (of which there are some poor strains which have to be avoided.)

Red Lake.—A new mid-season to late variety introduced into England from the Fruit Breeding Station, Minnesota, U.S.A. This variety was also highly spoken of in the eastern U.S.A. and Canada.

The blueberry is a delicious fruit; some varieties are over an inch in diameter.

We should investigate the possibility of growing black currants in higher rainfall and fertile areas of southern Victoria whence, in the last generation or so, it has almost disappeared.

BLUEBERRIES

The Blueberry of North America will be quite unknown to most Australians. To people who know it, I am sure it will appeal as one of the most attractive berries of any kind. It is of splendid flavour which appeals to everyone, is high in vitamin C, able to be transported long distances fresh, or to be canned and frozen. The blueberry industry is a valuable new and rapidly-growing one in U.S.A.

Many species of the genus *Vaccinium* or blueberry, occur in North America, ranging from the "low bush" type, about 1 foot high, to the "high bush" species, which may grow 10 to 15 feet in height. The Huckleberries are in this group, being blueberries native along the Pacific coast of North America.

The first commercial plantations were established by selecting large-fruited wild plants and vegetatively propagating them, but, during the last 30 years, plant breeders have obtained superior varieties by cross breeding. The largest wild fruits are about $\frac{5}{8}$ inch in diameter, but crosses between the species have given fruits up to $1\frac{1}{2}$ inch.

Most plantings in the north-eastern and western parts of the United States are of the high-bush type, and these require an acid soil of the order pH4 to pH5. This acidity is sometimes produced by adding flowers of sulphur.

Soils which have been unsuitable for other forms of agriculture have often been made extremely profitable under blueberries. Even poor, light, acid, sandy loams have been satisfactory where sufficient sulphate of ammonia has been used. The moisture supply must be uniform and continuous, as the high-bush blueberry will not stand drought. At Southhaven Experiment Station in Michigan, crosses between the high-bush and the drought-resistant low-bush types are being tested, and some of these, while retaining sufficient vigour in the plant, should prove much more drought-resistant and of wider interest to us in Australia.

Punnet of blueberries with attractive cellophane cover secured by a rubber band.

The Prevention of Sprouting in Stored Potatoes

By W. A. Downie, B.Agr.Sc., Agricultural Research Officer

The use of chemicals to inhibit sprouting gives promise of extending the storage and selling season of potatoes even after spring and summer temperatures have warmed the storage localities. This would serve as an advantage both to the potato grower, who would have a longer season in which to market his table potatoes, and for the consumer, who would have a longer buying season for old-season potatoes of good quality.

The results of this experiment are presented after only one season of trial because (1) they confirm essential features of overseas experience and (2) because of the necessity for making available promptly any procedures that might favourably influence food supplies.

The cost of the treatment has not been thoroughly worked out, and will probably depend on the demand. The small amount of information available indicates that it would cost approximately 3s. 6d. to treat a bag of potatoes of 150 lb., £2 to treat a ton and 30s. per ton for quantities 5 tons and upwards. These figures are approximate only and labour costs would have to be added.

It is necessary that any dusts used shall be in good mechanical condition to flow properly, and tinted the same shade of colour as the potato skin so that they will not be objectionable to the consumer.

Certain important points have not been mentioned in this article—such as, do such treatments impair the viability or germinating capacity of treated tubers or do they affect yielding capacity? A trial is at present being conducted to investigate these aspects, and the results obtained will be published at a later date.

This trial has been concerned simply with one variety, Snowflake, harvested in July. Any future work will incorporate all the commonly-grown commercial varieties and differential times of harvesting.

APART from losses due to mechanical injury, wastage in stored potatoes can be grouped into two main categories. In the first it is possible to include losses caused by disease and insect attack and physiological breakdown due to a faulty storage environment. To a large degree, these types of wastage may be prevented by the use of known measures of control of the diseases and pests involved, or by using approved storage methods. This wastage is usually obvious, and its extent can be readily determined. For this reason, and because individual losses may be high, it is apt to receive most attention, even though, in many seasons, stored potatoes may be little affected.

Fig. 1—Tubers and sprouts at the end of three months. Left: Tubers treated with talc dust. Right: Tubers dusted with M.A.N.A.

In the second category, losses, due to normal growth processes, are difficult to assess, and their extent is not always fully

realised. For these reasons they receive less attention than they should, in view of the fact that they occur to some extent in all storages every year.

Tuber weight losses due to respiration, loss of water and sprouting, are collectively known as " shrinkage ". Respiration causes a relatively small proportion of the total shrinkage and for practical purposes, can be ignored. Loss of water occurs through wounds received during harvesting, through the lenticels or breathing pores of the tubers, and also through the sprouts. Losses due to the last named cause, especially in the latter months of storage, are by far the most serious.

Sprouting causes shrinkage in two ways—by removing stored food material from the tubers, and, as indicated above, by increasing water loss. It is apparent, therefore, that any method of control of sprouting will have a dual effect in reducing shrinkage.

The extent of the loss due to sprouting is extremely variable, for it is dependent on variety, locality of storage and season. There is relatively little published information on this subject, but it may be interesting to note that potatoes stored in a barn at Ballarat in 1945 suffered a total loss in weight of 20 per cent. (1). The bulk of this loss occurred between September which is approximately the end of the dormant period, and the completion of the trial in November. Similar results have been obtained by English workers. (2).

During the past ten years considerable experimental work has been carried out, particularly in America, (3), in the use of chemicals for depressing sprouting in stored potatoes. Of the compounds tested, the most effective has been the methyl ester of alpha naphthalene acetic acid. In fact, overseas work on growth inhibiting substances for use on potatoes has advanced to such an extent that many firms are now marketing the above preparation.

Considerable interest in this experimental work has been exhibited by Victorian potato growers, and, with a view to testing the efficacy of the materials under local conditions, the following experiment was undertaken.

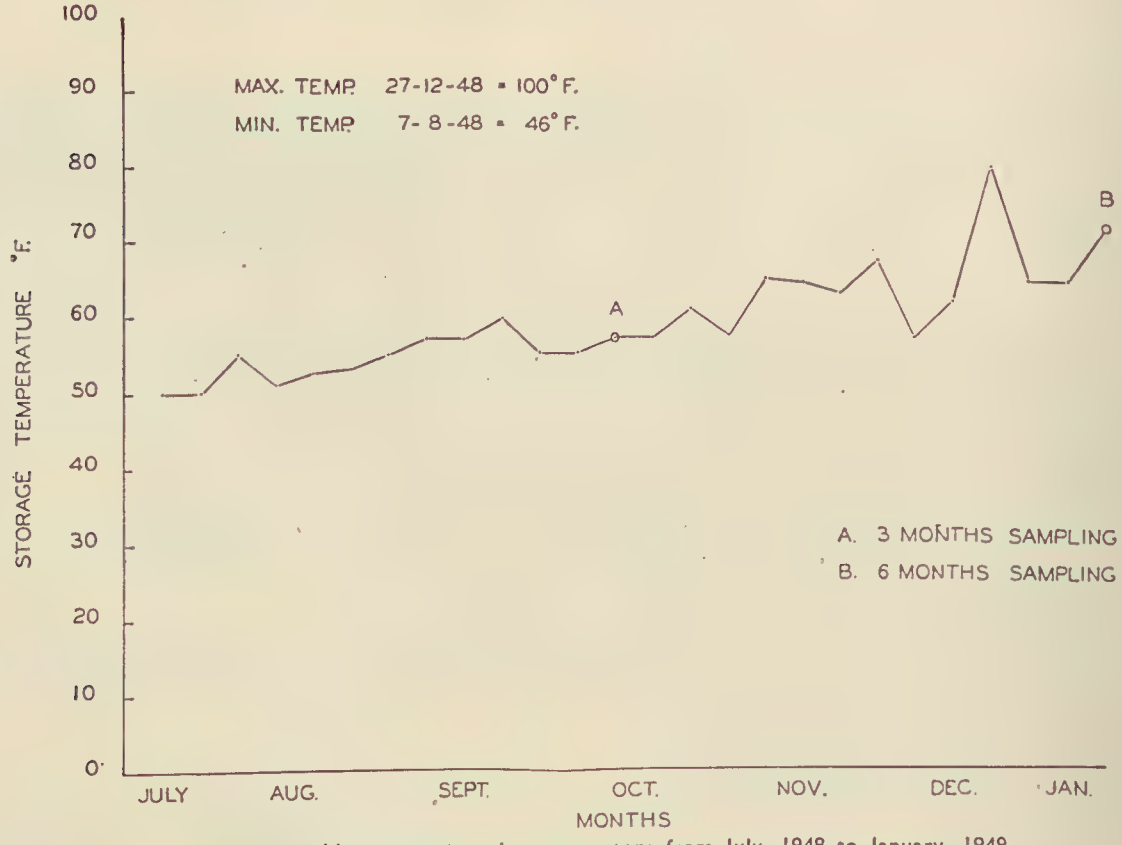


Fig. 2—Average weekly temperature in potato store from July, 1948 to January, 1949.

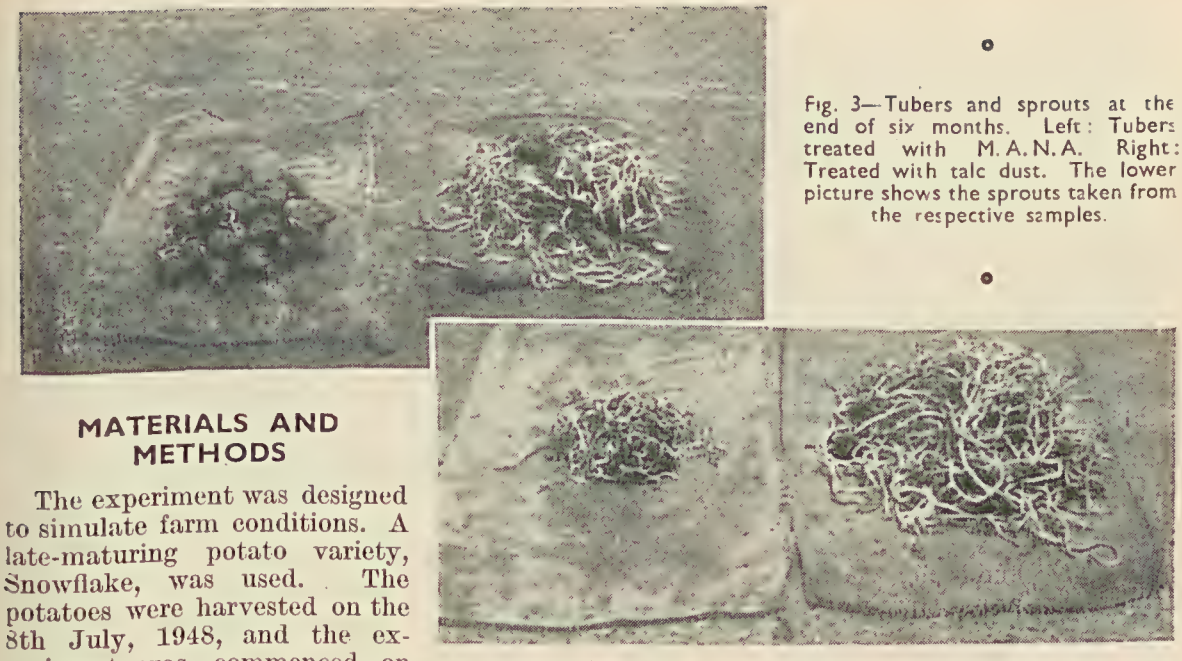


Fig. 3—Tubers and sprouts at the end of six months. Left: Tubers treated with M.A.N.A. Right: Treated with talc dust. The lower picture shows the sprouts taken from the respective samples.

MATERIALS AND METHODS

The experiment was designed to simulate farm conditions. A late-maturing potato variety, Snowflake, was used. The potatoes were harvested on the 8th July, 1948, and the experiment was commenced on the 15th July, in the store of the Potato Marketing Board at North Melbourne.

Quantitative measurements and other observations were made at the end of three months and again at six months. Each bag of potatoes was divided by a strip of hessian so that the three-month sampling could be removed, leaving the lower portion of each bag to complete the six-month period of the trial. Each sample was a weighed 70 lb.

The treatments used were as follows:—

1. Talc dust.
2. M.A.N.A.—Methyl ester of Alpha-Naphthalene acetic acid, used as a dust.
3. A.N.A.—Alpha-Naphthalene acetic acid, used as a dust.
4. N.B.C.—3 per cent. tetra-chlorinated nitro-benzene compound, used as a dust.

The recommended amounts of these substances were placed in the bags and shaken to ensure an even distribution to cover the potatoes.

Quantitative Experiment

In this experiment the efficiency as an inhibiting agent of A.N.A. was tested against M.A.N.A. while the potatoes treated with talc dust were used as the control. There were four replications of these three treatments. Because of the volatile nature of M.A.N.A. and A.N.A., only the blocks of treatments were randomised for position in the stack and, between each block, use was made of untreated bags of potatoes to act as buffer rows.

TABLE 1.—COMPARATIVE EFFECTIVENESS OF M.A.N.A. AND A.N.A. DEPOSITED AS A DUST IN PREVENTING POTATOES FROM SPROUTING.

Treatment	Three-Month Sample (Oct.)			Six-Month Sample (Jan.)		
	Mean Sprout Weight	Mean Loss of Tuber Weight	Mean Sprout Length	Mean Sprout Weight	Mean Loss of Tuber Weight	Mean Sprout Length
	oz.	per cent.	inches	lb. oz.	per cent.	inches
Control (Talc Dust)	17	8	2·2	6 3	36	9·2
M.A.N.A.	5	3·2	·9	1 5	23	1·5
A.N.A.	12	6·2	1·6	3 12	28·2	3·5
Significant difference necessary at level of 5 per cent.	4	1·2	..	0 7	5	..

A statistical analysis at the end of three months and six months was made on the data of average tuber weight lost and average sprout weight. A record of sprout length was also kept. The results are shown in Table. 1.

The data in Table 1 on sprout length, sprout weight and total tuber weight lost, all indicate that the M.A.N.A. was distinctly superior to other treatments. Tubers treated with the A.N.A. showed less sprouting than the control, but the sprouting was not inhibited nearly so well as with the M.A.N.A. where the results on sprout length and sprout weight were obviously significant from inspection.

Observational

Several brands of locally made and imported sprout prevention dusts, all containing M.A.N.A. as the active principle, were on hand. In addition, a chlorinated nitro-benzene compound (N.B.C.) was available, but not in sufficient quantity to be included in the quantitative trial. These several brands of the M.A.N.A. and also the N.B.C. were applied as a dust to single-bag lots of potatoes—split as before into two portions each of 70 lb.

The results of this portion of the trial are set out in Table 2.

An examination of the results achieved after the completion of storage for six months under normal spring and summer temperatures and humidities indicated that N.B.C. was markedly superior to M.A.N.A. With N.B.C. there was no evidence of sprouting of the potatoes, while loss of tuber weight for the period was 11 per cent. as against 23 per cent. with M.A.N.A. Another favourable feature connected with N.B.C. was the appearance of the tubers. To all intents and purposes such tubers appeared and felt in as good condition as at the commencement of the trial.

There was no injury to the tubers following any of the treatments. In this regard it should be mentioned that it was originally intended also to compare liquid versus dust applications with respect to A.N.A. However, the liquid supplied was of a greater concentration than is normally used and this treatment caused a complete breakdown after some weeks and was discarded. It nevertheless served the purpose of demonstrating that the use of a dust is the most practical method. Spray application results in irritation of the nose, skin and eyes of the operator. Spraying equipment is also generally more complicated than dusting equipment.

The blackening of tubers upon boiling is often a serious problem. To ascertain if the use of M.A.N.A. or N.B.C. in treating tubers, or if the inhibition of sprouting resulting from treatment had any effect in this regard, samples from these treatments, and also the control were tested. Neither the control nor treated tubers blackened when cooked. Apparently these treatments and the inhibition of sprouting do not induce blackening. Mention, however, should be made that, in the case of N.B.C. (and this was noticed only with potatoes which were "mashed") a minute amount of fibrous material could be separated from the normal flesh.

TABLE 2.—OBSERVATIONS ON M.A.N.A. AND N.B.C. DEPOSITED AS A DUST IN PREVENTING POTATOES FROM SPROUTING.

Treatment	Three-Month Sample (Oct.)			Six-Month Sample (Jan.)		
	Sprout Weight	Loss of Tuber Weight	Mean Sprout Length	Sprout Weight	Loss of Tuber Weight	Mean Sprout Length
	oz.	per cent.	inches	lb. oz.	per cent.	inches
M.A.N.A. (1)	4·5	4·3	9	1 7	23	1·6
M.A.N.A. (2)	5	3·6	8	1 3	23	1·6
M.A.N.A. (3)	5	4·3	8	1 8	25·5	1·7
N.B.C.	Nil	1·4	Nil	Nil	11·3	Nil

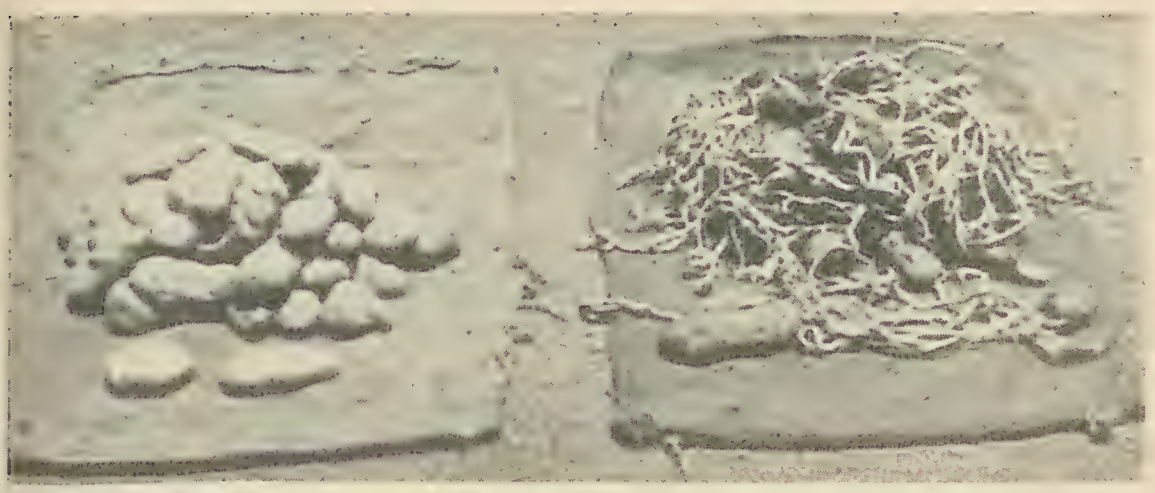


Fig. 4—Left: Tubers dusted with N.B.C. Right: Treated with talc dust. After six months' storage the tubers treated with N.B.C. showed no evidence of sprouting, and remained firm and attractive. The tubers treated with talc dust were shrunken, shrivelled and unfit for human consumption.

SUMMARY

The sprouting of potatoes during spring and summer has been completely prevented by the application of a chlorinated nitro-benzene compound. Sprouting was also prevented to an effective extent by the plant hormone, methyl ester of alpha-naphthalene acetic acid.

The nitro-benzene compound was the best of several compounds used, and this was reflected in the appearance and feel of the stored potatoes.

Application as a dust is a better method than as a liquid.

Treatment should be performed as soon as possible after harvest and before the advent of warm temperatures.

The treatments used were not found to induce blackening of the tubers when cooked.

Only one potato variety—Snowflake—has been tested to date.

NOTE—The author is indebted to Mr. R. Jardine, B.Agr.Sc., Biometrician, for advice on statistical matters and also to the various manufacturers whose products were used in this trial.

REFERENCE

(1) **G. B. Tindale and G. H. Mattingley.** "Cool Storage of Potatoes". *Journal of Agriculture, Vol.* 43, *Part* 10.

(2) **A. R. Wilson and R. K. McKee.** "Prevention of Excessive Sprouting in Late-Stored Ware Potatoes." *Journal of the Ministry of Agriculture, Vol.* 55, *No.* 7.

(3) **R. H. Daines and J. C. Campbell.** "Potato Sprouting Inhibited by the use of Alpha Naphthaleneacetic Methyl Ester," *American Potato Journal, Vol.* 23, *No.* 3.

Approved Seed Potatoes

THE following growers have been added to the list of approved seed potato-growers for 1949 :—

VARIETY—SEBAGO.

Name and Address of Grower.	Acreage.	Tonnage Approved.
Renzella, C., Weeaproinah, via Colac ..	8	40
Tann, W. H., Weeaproinah, via Colac ..	17	85

STOCK FOODS ACT

Brands Registered for 1949

By W. R. Jewell, M.Sc., Chemist for Agriculture

UNDER the provisions of the Stock Foods Acts, which are similar to other Acts controlling the sale of agricultural materials, the manufacturer or importer is required to register each brand of stock food and stock lick he proposes to sell. This provision applies to mixed, concentrated and prepared stock foods of all kinds, to by-products used for feeding and to stock licks, but it is not applicable to hay, chaff and whole grains sold as such.

The application for registration must disclose the raw materials from which the stock food is made, and the guaranteed minimum amounts of protein and fat, and the maximum amount of crude fibre. Protein and fat are, of course, important feeding constituents of any stock food, whereas crude fibre is of little value and the less present the better. In the case of stock licks, the guaranteed analysis is required in terms of major mineral constituents, such as lime, phosphoric acid and salt.

With cod liver oil, and with more recent vitaminised oils derived from shark liver, the vitamins A and D are the all-important ingredients, and the guaranteed analysis is in terms of these vitamins. The Act requires that the vitamin content must always be shown in the same uniform way, namely as International units per gram of oil. Analyses are therefore all declared on the same basis, so that an accurate comparison of the different brands is possible. In selecting a particular oil, the purchaser should be guided by these guaranteed quantities of vitamins rather than by any extravagant claims which may be made by the seller.

Every package of stock food should bear a label showing the brand, the name and address of the manufacturer, the weight and the guaranteed analysis on which the registration is accepted. This labelling requirement is made solely for the protection of the purchaser, who should see that any stock food he obtains is so labelled. In these days of general shortage of feeding stuffs of all kinds, there is a tendency to buy what is available without due consideration to feeding value, but it still pays to buy only labelled bags and to give some thought to the analysis.

The list of registered stock foods and stock licks for the current year is given on page 328 of this Journal; it should be of interest to all farmers and should be retained for future reference. The list follows the general lines of those of previous years and the brands are grouped into convenient classes. The number of brands registered has not varied much in recent years; this year 415 separate items are listed.

Protein concentrates of animal origin are classed under different grades according to protein content. Standards have been set for these grades and a blood meal must contain not less than 75 per cent. of protein, a meat meal 55 per cent. and a meat and bone meal 45 per cent. A still lower grade—bone and meat meal—is also registered with 40 per cent. protein. Meat meals and kindred products are still in short supply and are difficult to obtain except in rationed quantities to regular customers.

Any enquiries regarding stock foods and any complaints regarding unlabelled bags, etc. should be addressed to the Chief Chemist, State Laboratories, Gisborne-street, Melbourne, C.2.

LIVE STOCK NOTES

Compiled by A. C. T. HEWITT, M.Agr.Sc.,
Live Stock Science Officer

THE CHEAPNESS OF PASTURE

PASTURE is the cheapest of animal foodstuffs and when properly managed, supplies one of the most nutritious fodders. It is the cheapness of producing pasture that has made our dairy, beef, wool and lamb production profitable. Food units are produced in pasturage for one farthing per lb. and in 100 lb. of pasture there are 14 lb. of food units, which cost 3½d. 100 lb. of pasture has a food value equal to 23 lb. of oats, which cost 3/4d.

Animals are like humans in that they require a continuous supply of food throughout the year. A dairy cow when dry requires about 65 lb. of good green pasture or its equivalent in other food each day and for each gallon of milk she produces she must have another 30 to 35 lb. of pasture. A cow producing 400 lb. of butterfat in the year consumes about 24 tons of pasture. A sheep needs about 7½ lb. of green pasture a day, whereas a ewe with lamb at foot requires about 15 lb. per day. The ewe, with lamb sold fat when 16 weeks' old, grazes about 1¾ tons of green pasture in the year, whereas the dry sheep consumes about 1¼ tons.

High-producing animals must be given the food as they need it and this is where the greatest problems of live stock farming are met. Grass and clovers, which form the bulk of the forage in a pasture, do not grow at an even rate throughout the year. Most of the growth is in September, October and November when the animals cannot cope with it, but for the rest of the year it is insufficient for normal requirements. For instance, the average growth over six years at Glenormiston in the Western District was about 12½ lb. per acre per day from January to June. Then in July it rose to 25 lb. per day, increasing to 75 lb. in August, to 150 lb. in September, to 200 at the peak in October. By November it had dropped to 100 lb. per acre per day and to 50 lb. by December.

When such pastures are used for dairying, and the grazing rate is one cow to 2½ acres, sufficient food is available to the cows only during September, October and November. During the other nine months of the year cows need supplementary food which should be provided from the hay or silage conserved from the surplus spring growth.

The growth of pasture on a good property at Caldermeade near Koo-wee-rup, averaged 16 tons per acre per year—13 tons from July to December and 3 tons in the other six months of the year, varying from 60 lb. per acre per day in July to 225 lb. in October and then to 25 lb. in February and March.

The growth at Caldermeade was the heaviest measured on any farm in plots conducted by the Victorian Pasture Improvement League, but it did not provide sufficient food for the cattle all the year round. If such a pasture were grazed at the rate of one dairy cow to 1½ acres, about 3 tons of green pasturage would be wasted on each

acre during the spring and for the rest of the year there would be insufficient food. The procedure would be to close up four acres in every ten about the middle of August and run the herd on the remaining area of the farm. The areas closed up would be cut for hay or silage, cutting 2 tons of hay or 5 tons of silage per acre. The hay and silage would then be available to feed as required throughout the rest of the year.

[A.C.T.H.]

DAIRYING QUESTIONS PUT TO DR. PETERSEN

The following are the answers to some questions put to Dr. W. E. Petersen, Professor of Dairy Husbandry, University of Minnesota, U.S.A., when he visited Victoria towards the end of last year.

Highest Total Production.—The highest total butterfat production is obtained from cows when their calving intervals are not longer than twelve months apart. Delays caused by temporary sterility result in big losses of total production.

Dehorning.—Cows should be dehorned. Observations have shown that there is some loss of production at the milking following dehorning, but production is usually back to normal by the second milking after the cows are dehorned.

Dogs.—If dogs are properly controlled, the rounding up of cows with dogs is quite satisfactory and frequently dogs are less severe on the herd than some attendants.

Drugs to Increase Production.—There are drugs like iodized casein which will increase milk production by as much as 25 per cent. but to get this increase of production, the cows need much more food and "we don't get anything for nothing". By the use of these drugs, breeding troubles are increased and the length of life of the cow is reduced.

Leg-roping.—It is not customary to leg-rope cows in America and the reason for leg-roping cows in Australia appears to be due to the fact that the cows have not been trained to milk and stand quietly without leg-roping. Flies are believed to be just as bad in America as in this country and the need for leg-roping here on that account is no greater than it would be in America. A considerable amount of work is eliminated when cows are trained to be milked without the use of leg-ropes.

Milking Prior to Calving.—The removal of milk before calving is advised when the swelling of the udder is greater than normal. Large, swollen udders are liable to mastitis, likely to become pendulous, and more difficult to extract milk from. Milking prior to calving will prevent such udders swelling abnormally, but when cows are milked prior to calving, the colostrum should be preserved by freezing for feeding to the calf when it is born.

Hand Milkers.—The very best hand milkers in America are men, but the majority of women are good milkers and do a good job.

Music in the Cow Shed.—Radio music in the cow shed during milking time does not have any direct bearing upon milk production but it has an indirect effect by reducing the upsets to cows brought about by abnormal noises which may occur.

Observation Glasses.—Observation glasses along the milk line are favoured if too much confidence is not placed in them. The milker must depend upon his own good judgment and his intimate knowledge of each cow to determine when all the milk has been drawn from her.

Transparent Teat Cups.—Transparent teat cups made of plastic or glass have been tried in America, but they are too easily damaged to be practicable. Transparent plastic teat-cup liners are too costly, and until transparent plastics can be made which will withstand scratching and heat their use is not likely to be practicable.

Vacuum Brakes.—Vacuum brakes are unknown in America, but the general American experience is that the fewer gadgets there are on a machine, the better.

Ribbed Inflations.—Dr. Petersen regards these with suspicion and although they may milk faster they do not collapse around the teat sufficiently to massage it properly, and may therefore be dangerous.

Drying Cows Off.—The method of drying off which gives best results is to stop milking the cow.

Stocking of Udders.—The stocking up of the cow's udder for sale and exhibition purposes predisposes her to mastitis.

REARING CALVES ON LITTLE MILK

On farms producing butterfat, calves can be reared cheaply and well on skim milk and pasture and, on farms producing whole

milk, gruels made from concentrates can be used to replace all but 25 gallons of whole milk in the total ration. This milk will be fed during the first four or five weeks of the calf's life.

Where little milk is available and large quantities of gruel are fed, it is most desirable that the calves receive plenty of grazing on good fresh green pasture. Half-a-pound of pollard or finely-ground wheat and half-a-pound of linseed meal, boiled in one gallon (10 lb.) of water to which one teaspoonful of ground limestone and one of salt have been added, and which has been cooled to 90° F., provide an excellent meal for a six-weeks'-old calf.

Gruels can be made from any of the following :—(1) pollard or finely-ground wheat; (2) equal parts of pollard or finely-ground wheat and linseed meal; (3) equal parts of finely-ground wheat and skim milk powder; (4) skim milk powder; (5) three parts of finely-ground wheat, three parts of dried whey and two parts of good quality meatmeal.

Of the above mixtures, gruel No. 1 has the lowest food value. One teaspoonful of limestone should be added to all gruels which do not contain a large proportion of skim milk or skim milk powder. The calf will do much better if gruels can be supplemented with a small amount of new or skim milk.

The average-sized calf should be given the following quantities in at least two feeds a day :—

REQUIREMENTS OF MILK AND MILK SUBSTITUTES FOR CALVES OF AVERAGE SIZE—60 LB. BIRTH WEIGHT.

—	Milk. (3·5 per cent. Butter Fat.)	Skim Milk or Substitute Gruel.
	(lb. per day.)	(lb. per day.)
First week	Up to 12	..
Second week	12	..
Third week	9	5½
Fourth week	6	11
Fifth week	3	16½
Sixth to twenty-fourth week	..	22

As the calf grows, additional feed should be provided as pasturage or good quality hay. [A.C.T.H.]

POULTRY LITTER

While it is desirable to have clean litter in poultry pens it is just as desirable to assure that the litter is dry. The floors of the pens should be covered with six to eight inches of litter. This acts as insulation against cold, and provides comfort and interest for the birds, especially those kept under intensive conditions.

The usual recommendation is to change the litter regularly four times a year, but experience has shown that this does not work out in actual practice. Poultry farmers have learned that litter cannot be successfully replaced during winter, as it becomes damp and caked with excreta before it is broken down. The litter will persist in this condition just as long as the cold wet weather continues.

The reason for replacing old litter with new, is to reduce the heavy concentration of internal parasites which are deposited through the droppings, but if the removal of soiled litter brings about a reduction in general comfort of the birds, the old material should be retained until the weather is more suitable for cleaning out.

Dust baths have been dispensed with in poultry sheds, as birds prefer to dust themselves in the litter, provided it is deep and dry. When well broken down and combined with dry, powdered manure, litter absorbs moisture, and is very effective during frosty weather, in sheds with corrugated iron roofs.

Quite a number of poultry farmers clean the pens out twice a year and some prefer only once a year, but if clean, fresh conditions are desired it is necessary to change the litter in September, December and March, with additional quantities during April to maintain congenial conditions during autumn and winter.

The use of "deep litter" appears to be increasing in popularity. The idea is to remove only portion of the old litter and replace with new, to increase the volume of material and keep it in dry, friable condition.

Without reference to the relative merits of "deep litter," the old, soiled material retained in the pens, especially in or during the moulting period, does spoil the appearance of the poultry houses, and often develops a bad odour.

The method applied in feeding the evening grain has a bearing on the condition of the

litter. If fed in hoppers the birds lose the incentive to scratch in the litter which eventually becomes caked on the surface. When the grain is broadcast over the floor the birds scratch vigorously in the litter, turning it over to keep it in a dry, friable condition.

[M. D. Hall—Poultry Expert.]

INFLUENCE OF RIBOFLAVIN AND MANGANESE ON POULTRY BREEDING

Recent oversea experiments have shown the importance of certain minor elements and vitamins in the diet for satisfactory growth and reproduction in the fowl. Of these the most important is probably riboflavin, a member of the vitamin B group, which is essential for good hatching results and growth of the chicken. Also important is vitamin D3, well-known to most by now, but not so well known is that the manganese content of the diet is related to the efficient use of this vitamin, as well as being necessary for the prevention of perosis or slipped tendon in growing chickens.

One effect of insufficient riboflavin in the diet of breeding hens is that their eggs are also deficient in this vitamin. Such eggs do not hatch well, many embryos dying in the fourteenth to eighteenth day of incubation, or if they survive to hatching are unable to get out of the shell.

A characteristic of such riboflavin-deficient embryos is the " clubbed " down, as though the down failed to emerge through the skin, but this is not evident in all such embryos. Chicks which do hatch, unless fed a diet adequate in riboflavin, will soon show the typical nervous symptoms of riboflavin deficiency ; this occurs whether the eggs were deficient or not, although chickens from non-deficient eggs would have greater reserves.

The part played by manganese as far as hatching ability is concerned is a little more indefinite except that it acts as a saver of vitamin D3, which is usually available in adequate quantities in fish oil or is synthesised in the birds' own bodies in the presence of direct sunshine. Its most important function is in the prevention of perosis in the growing chicken. Here again those that have had an adequate amount both from the egg and in the diet fare best.

Normally both riboflavin and manganese were supplied in adequate quantities in the feeds available before the war. The skins of grains, chiefly wheat, are rich in both factors, but bran and pollard are in short supply. Milk and milk products and also liver-meal are very rich in riboflavin, but are scarce and expensive at present, so it is actually cheaper to use the synthetic riboflavin. This is available commercially at most produce stores and chemists.

A sufficiency of manganese is best ensured by adding 1 lb. manganese sulphate to 40 lb. salt and feeding the salt in the normal way at the rate of 1 to 1½ per cent. This is equivalent to forty parts per million of manganese (the requirement is fifty p.p.m.). Manganese sulphate (crude) is available from chemists.

While vitamin A can be supplied in fish oil, it is not a good idea to cut out green-feed altogether as, besides being palatable and adding variety to the diet, it supplies other minor elements and vitamins which may yet be shown to be important in poultry nutrition. For instance, good quality green-feed such as lawn-clippings or lucerne, supply some riboflavin and manganese. Incidentally, although vitamin A has not been shown to be necessary in improving the hatching quality of eggs, it is essential that both breeding birds and growing stock receive it in adequate quantities to ensure good health.

[Irene J. Stewart, B.Agr.Sc.,
Livestock Research Officer.]

Walnut Growing in Victoria

By G. W. Gayford, B.Agr.Sc., Senior Horticultural Instructor

THE growing of walnuts appeals to many people either as a sideline to be grown in conjunction with other crops or as a commercial proposition as a single crop. There is a strong demand for walnuts and growers could increase this demand by the careful grading of nuts and the production of whole kernels and chopped pieces.

A grove of twenty-year-old Franquette walnut trees at Gapsted, North-eastern Victoria.

Until recent years there have been few commercial groves in Victoria. This is probably due to the fact that walnuts cannot be grown economically in many parts of the State, and most people are not content to wait the ten or twelve years before the trees commence yielding profitable returns. Therefore, established groves have been planted only as adjuncts to other crops, or as long-term investments. Difficulties in propagation and consequent shortage of trees are also a deterrent to increased planting.

The two main factors causing losses in established groves are walnut blight, a disease which is present in all walnut groves and is difficult to control and secondly, damage by late spring frosts. These two factors may cause losses of anything up to 75 per cent. of a crop in some seasons and it is therefore most important that before consideration is given to commercial plantings, careful thought should also be given to suitability of districts and varieties.

DISTRICTS AND CLIMATE

For home or farm plantings there are not many parts of Victoria where the walnut cannot be planted as a shade or ornamental tree, but as a commercial venture the scope is more limited.

An ideal situation would be one which is frost free, has a mild dry spring period, and is not exposed to the scorching northerly winds of the summer. A rainfall of 35 to 40 inches is desirable, but lower rainfall districts with irrigation facilities would be suitable.

The walnut is susceptible to frosts at flowering time and shortly afterwards. The young developing nuts are particularly susceptible to damage. Hot winds during the summer scorch the foliage and nuts, and showery humid weather in the spring causes walnut blight to spread rapidly and if such conditions continue during the summer, heavy losses of nuts may occur.

Because of the vigorous growth of roots and tops of the trees, a deep well-drained soil is required. The roots are susceptible to soil water-logging.

Northern Districts

Trees may be grown successfully in northern irrigated areas with suitable deep soils, but hot winds during the summer cause scorching of leaves and affect productivity and growth. In sheltered situations and for home planting walnuts grow well in the warmer districts.

North-Eastern District

The largest plantings in Victoria are on the Ovens river in the Myrtleford district. The largest single grove is at Gapsted where the soil is deep and well drained except for occasional banks of clay which sometimes cause trouble. Spray irrigation is used during dry periods in the summer.

Blight is a problem in some years and occasional late frosts cause crop losses. Trees make good growth in these congenial alluvial soils and in some seasons heavy yields are obtained. One individual tree yield of 450 lb. of nuts has been recorded.

Smaller groves in this district also make satisfactory growth and yield well in favourable seasons. Increased plantings are being made on the Buffalo river and other suitable areas.

East Gippsland

River flats in this area are generally well suited to walnuts and some of the finest trees in the State grow here, yields of up to 5 cwt. of nuts per tree being obtained. The climate in most parts of East Gippsland would be suitable for walnuts, but frosts may be a cause of loss in some seasons.

Southern Districts

In the deeper soils of the Dandenong Ranges, walnuts grow satisfactorily but showery spring weather induces walnut blight. The rainfall is generally sufficient except in some seasons when soil moisture from January to March is inadequate.

An old seedling walnut tree at Wandiligong, Victoria.

VARIETIES

Many of the trees growing in Victoria are seedlings which produce nuts of variable quality. Undoubtedly some of the seedling trees are of good type, but for satisfactory production, seedlings are so variable that they cannot be recommended and varieties of known characteristics only should be planted.

The rootstock most suitable for propagation is the Northern Californian Black. (*Juglans Hindsii*). This stock produces vigorous trees.

In a commercial plantation it is advisable to plant a range of varieties for pollination purposes. Male and female flowers are separate, the male flowers or catkins arising from shoots of the previous season's growth while the female flowers occur on new shoot growth. The discharge of pollen does not always coincide with the receptive stage of the stigma on any one variety and this problem is overcome to some extent by planting a range of varieties. The pollen is carried by wind from one tree to another. In the United States of America some growers collect pollen from the male flowers in early-flowering trees, hang this in muslin bags in later-flowering trees and each day during the blossoming period knock the bags with a stick to discharge the pollen.

The following varieties have been most satisfactory under Victorian conditions :—

Franquette

An introduced variety which produces good quality nuts and is fairly resistant to walnut blight. It is late flowering and therefore less liable to frost damage.

Myrtleford Jewel

This variety was obtained from a seedling tree originally growing at Wandiligong, North-eastern Victoria. It was selected because of the high quality of the nut and its relative resistance to blight.

Treyve Mayette

An introduced variety which also shows resistance to walnut blight.

TUBERCULOSIS IN CATTLE

By W. A. Snowdon, B.V.Sc., Veterinary Stock Inspector

TUBERCULOSIS in farm animals may be viewed from two aspects—first and most important, the risk to the community's health; and second, the economic loss due to the lowered productive capacity of affected animals and their subsequent slaughter.

METHODS OF INFECTION

Methods of control used in the prevention and eradication of tuberculosis in farm animals will be better understood if the various avenues through which the animals may be become infected are known. The principal source of infection in cattle is infected food or water. The food and water may become contaminated by infected sputum coughed up, or by dung passed out by an affected animal. The feeding of milk from tubercular cows, especially where the cow has a tubercular mastitis, is an almost certain method of producing tuberculosis in calves.

Where cattle are in close contact, such as in the bails at milking time, there is a grave danger of spread of the disease by the inhalation of infective droplets coughed into the air by animals suffering from pulmonary tuberculosis.

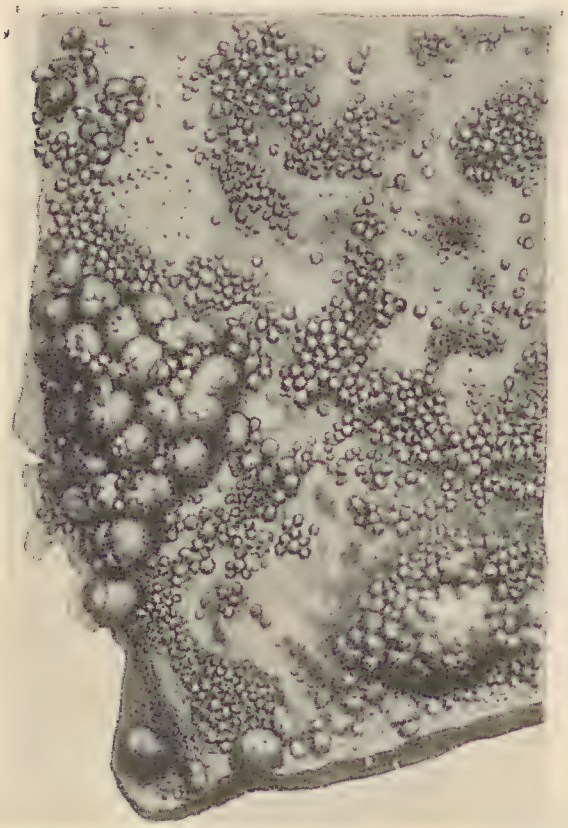
T.B. infection in pigs is usually the result of feeding milk from infected cows or feeding unsterilized whey or buttermilk. Where pigs are allowed to wander with cows to make use of grain that has passed out undigested in the dung, the probability of the pigs becoming infected increases greatly. Cows, however, are not the only source of infection to pigs, as tubercular poultry allowed to stray in the pig yards and runs, can also cause trouble.

SYMPTOMS

The great difficulty in diagnosing tuberculosis in cattle is the lack of symptoms shown in the early stages. The cattle may have been noticed to be unthrifty and to have a decreased milk supply, but these two features alone are not sufficient to diagnose tuberculosis. However, there is good cause to suspect tuberculosis if the animal has been wasting away over a long period. It must be borne in mind, however, that a cow may be in excellent condition, yet, at the same time, be a very bad case of tuberculosis, and a grave source of danger to other cattle in the herd. Such cases as these often cause a breakdown in any scheme of eradication. Later in the course of the disease, the affected animals may emit a persistent cough, which is at first

These well-constructed milking sheds and feeding bails, sited to afford the maximum benefit from direct sunlight, facilitate disease control.

harsh and dry and later becomes moist. If the lymphatic glands are affected, which is often the case, they may show up as swellings in the throat region, below the ear, and possibly in front of the shoulder and stifle.



Small nodular tubercles from the pleura of a cow.

Enlarged tubercular glands may be picked up by pressure with the fingers on either side of the udder or testicles around the region of attachment to the abdomen. When the glands in front of the throat region become grossly enlarged they cause pressure on the windpipe, resulting in a snoring type of breathing which can be heard some distance away. In many cases where tuberculosis is unsuspected, and where the milk is fed to pigs, the first sign of the presence of the disease may be indicated in the carcasses of the pigs after slaughter. This is especially the case with baconers and porkers.

In the sows, the history may be somewhat different, the animals being in good condition until farrowing, when they suddenly lose condition, are unable to feed their young, and die within two or three months.

POST-MORTEM APPEARANCE

When an animal suffering from tuberculosis is slaughtered and a post-mortem is carried out, the organs showing involvement may vary in each case. Most commonly the lymph glands, the lungs, and lining of the chest, and the internal lining of the abdomen are affected. The lymph glands associated with the liver, testicles, udder, kidney, and intestines may also be involved.

The tubercles, as the growths of tuberculosis are called, may vary from a hardly perceptible spot to a mass several pounds in weight. Sometimes the lining of the abdomen and chest may be covered with hundreds of tubercles, varying in size and arranged in clumps. The typical picture that the farmer will see on cutting into one of these tubercles is an outside fibrous coat surrounding an orange-yellow mass. This mass is usually firm and gritty but on occasions may be soft and resembles thick pus.

TREATMENT

Although many different drugs have been used over the years in the treatment of tuberculosis, none has proved satisfactory.

Surgery, in combination with some of the later drugs and long periods of convalescence, have prolonged the life and cured some human sufferers of tuberculosis. Due to the relatively small economic value of our domestic animals, and the uncooperative nature of these animals as patients, the above methods, however, are not applicable to stock. Therefore, the farmer should be wary of unscrupulous individuals who claim to be able to cure his animals of tuberculosis.

ERADICATION

The eradication of tuberculosis from the herd is one of the important aspects with which the farmer should interest himself. Since it is impossible for the farmer to detect early cases of tuberculosis in his cattle, he should enlist the services of a veterinarian who will carry out a recognized tuberculin test for tuberculosis.

It is compulsory for those farmers supplying milk to the Melbourne and metropolitan area for human consumption to have their herds tested. The test is carried out at the Government's expense by the

veterinary staff of the Department of Agriculture or by private practitioners. The same facilities are available to those farmers supplying milk to a number of provincial centres. Applications for tests should be made to the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

Farmers supplying cream to butter factories are left to decide for themselves whether or not they have their herds tuberculin tested. If, however, a clinical case of tuberculosis has been diagnosed in the herd, officers of the Department have the power to enter the property and test the herd. Although many farmers object to the tuberculin test being carried out in their herds because of the fear of condemnation and slaughter of a proportion of their stock, the value to the owner of a tuberculosis-free herd far outweighs such an objection.

In Victoria, the owner receives compensation for cattle which have been condemned as suffering with tuberculosis. This is equal to three-quarters of the market value of the condemned animal with a maximum valuation of £25. The value is fixed by agreement between the owner and the inspector or other officer representing the Government appointed under the *Cattle Compensation Act* 1928. If no agreement can be reached between these two parties, the valuation is made by a competent and impartial valuator nominated by the Minister of Agriculture.

PREVENTION OF RE-INFECTION

After reactors have been removed the following routine, if thoroughly carried out, will go a long way towards keeping a herd free of tuberculosis.

1. Thoroughly sterilize feeding troughs. Where these are made of wood or cracked material, they should be dismantled and burnt. Feed troughs of smooth surface, consisting of cement or impervious metal, may be sterilized by first removing all caked mucus, fodder, &c. This is done by thorough scraping and washing with boiling water and caustic soda. Allow this to stand in the trough for some time, and then wash the trough with clean boiling water. Water troughs should be treated similarly. Once this procedure has been carried out, daily hygiene should be adopted to see that they are maintained in a clean state.

2. Where possible, communal watering troughs for farm livestock should not be used, and stagnant water should be made inaccessible to stock.

3. The floor of the milking shed should be scraped, washed with boiling water and caustic soda, and then hosed down with water.

4. Milk from tubercular cows, whey and buttermilk, and other by-products of cheese and butter factories should never be fed to calves or pigs unless first sterilized by boiling.

5. Cold disinfectants such as those commonly used for washing teats will not kill the tubercular organism because of the waxy coat which envelops it. Sunlight is possibly the best disinfectant known against the organism of tuberculosis, and its use should be fully exploited. For instance, paddocks should be harrowed to scatter the dung packs and allow the sunlight to enter, thereby decreasing the possibility of reinfection of the herd from the pasture.

6. All cattle introduced into the herd should be certified as tuberculosis-free, or placed in isolation until they are tested.

7. To enable the farmer to assess the value of his methods of hygiene he should have his herd tested at regular intervals. The routine adopted in herds supplying milk to the Melbourne and metropolitan area is as follows :—

If reactors to the tuberculin test are discovered on the first test the herd is re-tested again in six months. If more reactors are found, the test is repeated again in six months, but, if the herd is found to be tuberculosis-free, it is not tested until twelve months later.

The next test, if the herd is clean at consecutive twelve-monthly tests, is made in two years. Untested cattle are tuberculosis-tested at the time of introduction into the herd.

The farmer can be assured that he will have little or no trouble with tuberculosis in his cattle if he adheres to the above recommendations.

CERTIFIED PULLORUM-TESTED FLOCKS (POULTRY)

A certified Pullorum-Tested Flock is one in which all stock over six months of age have given a negative reaction to the agglutination test for Pullorum Disease, and in which all such stock are kept under rigid conditions of isolation approved by the Chief Veterinary Inspector.

The undermentioned flocks have been certified by the Department of Agriculture, and will remain so for the current calendar year, or until such time as the Chief Veterinary Inspector determines.

Application forms are obtainable from the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

Particulars of breeds of birds tested are as shown hereunder:—

A. Australorp; B. White Leghorn; C. Rhode Island Red; D. Sussex; E. Langshan; F. Brown Leghorn; G. Buff Orphington; H. Black Leghorn; I. Minorca; J. Ancona; K. Legbar; L. Indian Game.

Owner.	Breed.	Number of Birds.
Anderson, G. M., Greensborough-road, Macleod	A	1,488
Anguey, H., 138 Hargreaves-street, Castlemaine	A, B	725
Arnold, J. B., Terrara-road, Vermont ..	A	810
Ashgrove Poultry Farm, Cockatoo ..	A, B, C, D	3,035
Baker, J., Greensborough	A	1,077
Barastoc Experimental Farm (G. Lee Manager), Croydon	A, B, C	716
Bayfield, A. E., Seven Acres Poultry Farm, Springvale	B, C	1,374
Bingley, A., 333 Highbury-road, Burwood..	A, B	2,108
Bishop, Mrs. P. M., Springvale-road, Springvale	A, B, C,	1,810
Boyce, A. D., Springvale-road, Forest Hill	B	1,097
Bray, J., 18 Hotham-street, Warrnambool..	B	140
Brumby, W. E., Ellendale-road, Noble Park	A, C	438
Burney and Pound, North-road, Langwarrin	A, B	1,731
Cannings, P. G. A., Shepparton East ..	B	3,932
Carlella Poultry Farm (J. W. Stoneman), Campbell's-road, Briar Hill	C, F	272
Cashin's Poultry Farm, 2 Dawson-street, Stawell	A, B	2,528
Chalmers, H. L., 9 Lefevre-street, Spotswood	B, F, K	582
Chamberlain, L., Nathalia	A, B	1,984
Chapman, Mrs. E., Youanmite	A, C	282
Christie, R. R., and Son, Tucker-road, Bentleigh	A, B, C	879
Cole, R., Mooroopna	B, C	416
Collins, A. J., Emerald	A, C	354
Colquhoun, Dr. W. L., "Aringa," Ringwood	A, B	195
Cook and McKnight, Croydon	A	1,568
Corbett Bros., Torbay-street, Macleod ..	A	2,318
Davidson and O'Keefe Hatchery (Mrs. M. H. Turner, Prop.), 22 Sherwood-avenue, Ringwood	A, B	75
Davies, L. F., Westall-road, Springvale ..	A, C	1,368
Davis, N. W., Mickleham, via Broadmeadows	A, B	3,089
Dawson, R. G., Maldon-road, Castlemaine..	B	1,285
Day, L., Box 39, Kyabram	A, B, C	1,778
Deakin, J., 21 Troy-avenue, Bonbeach ..	A, B	301
Dugan Bros., Broadmeadows	B	8,864
Ellen J. Rossmoyne Pig and Poultry Farm, Avoca	A, B	1,919
Emmott, J. T., Verdon-street, Inglewood ..	A, B	293
Farmer, C. R., Whitehorse-road, Ringwood	A, B, C, D, K	2,260
Fellows, J., Yan Yean-road, Plenty ..	A, B, C	859
Fitchett, C. W., Spring Vale-road, Tally Ho	A, B	1,484
Fletcher, J. H., "Homeleigh," Tallygaroopna	B	1,621
Ford, J. V., 11 Barkers-avenue, Shepparton	A, B, C	1,026
Fraser, R. A., and Son, Colchester-road, Kilsyth	A, B, C	947
Frye, I. H., Grimshaw-street, Watsonia ..	A, B	1,937
Gedye Bros., Railway-road, Blackburn ..	A, B	3,775
Giarrusso, G., Lower Dandenong-road, Braeside	B, C	462
Gibbs, A. E., Stanhope	A, B	3,734
Gibbs, J. L., Lower Plenty	A, B	983
Grenville Poultry Farm, Springvale-road, Springvale	A, B, C	3,666
Guy, J., "Murlea," Murgheboluc.. ..	A, B, C	670
Gwyther, R. P., "Woorrayl," Highton ..	A, B	1,144
Hamblin, N. A., Sunny Hill Poultry Farm, Toolleen	A, B	3,423
Hanson, S., Kilmore	A	237
Harrington, G. W., Springvale-road, Tally Ho	B	1,836
Harrington, W. H., Woodward-street, Golden Square	A	1,597
Harrison, A., Shenfield-street, Cobden ..	A, B, C, D	300
Hayes Bros., Mount Dandenong-road, Montrose	A, B	3,564
Henderson, C. W., Shepparton	A	395
Hewett, A. T., Central-avenue, Croydon ..	A, B	866
Hopkins, C. A., and Sons, Success Poultry Farm, Knight-street, Shepparton	A, B	1,656
Hunt, R. R., 365 Highbury-road, Burwood	A, B	1,298
Hurst, B. H. G. (Mrs.), New-street, Eltham	B	2,768
Ikin, E. J., 44 McKay-street, Seddon ..	C	86
Inglis, W. J., Cobham-road, Mitcham ..	A, B	530
Jackson, Miss E. M., 4 Monash-street, Box Hill	B	48
James, D. E. and K. D., Spring Gully, via Bendigo	A, B, C	1,127
Johnson, A. S., Burwood-road, Ferntree Gully	A, B, C	2,282
Kay, V., 12 Wellington-street, Blackburn ..	A, B	2,634
Kennedy, F., Ferntree Gully-road, Glen Waverley	A, B, C	677
Kerr, J. J., Clarke-road, Springvale ..	A, B	2,052
Lang, J. L., 46 Dundas-street, Thornbury..	E	104
Lattimore, A. G., Kilsyth	A, B, C	817
Lintermans, W. A. J., Major-road, Lysterfield	C	1,160
Lonie, R. A., 1 Chanak-street, East Malvern	A, B, C	37
Lucas and de Molnar, 4 Downong-street, Blackburn	A, B	1,639
Magnusson, L., Nathalia	B	936
Maher, A. E., Wal Wal	A, B	765
Major, C. D., Simpsons-road, Eaglehawk ..	A, B	2,000
Marshman, A. R., Archie's Creek ..	A, B, C	767
McCabe, R., Gladstone-road, Dandenong ..	A, B, D	2,079
McCann and Sons, Crowlands-road, Stawell	B	4,198
McEwan, A. W. H., Whitehorse-road, Ringwood	A, B, K	157
McLauchlan, D. F., Rossiter-road, Koo-wee-rup	A, B	2,500
McTighe, C. H., Nar-Nar-Goon	A	571
McVay, A., Kernot-street, West Spotswood	A, B	2,506
Mills, J. J., Kelvinside-road, Noble Park ..	C	267
Mold Bros., Banbury Park Poultry Farm, Old Narre Warren-road, Emerald	A, B	1,141
Molsons White Leghorn Stud (G. Durkin, Man), 188 Surrey-road, Blackburn	B	1,311
Moran, S. G., Glenburnie-road, Mitcham ..	A, B	732
Moroney, J. B., Kangaroo Flat	B	1,150
Mumford, L. J., Healesville	A	400
Neal, J. H., 18 Watt-street, Spotswood ..	L	22
Niewand, F. J., "Kalang," Lubeck ..	A, B, C	1,275
O'Brien, R. J., Watson-road, Glen Waverley	A, C	694
Paton, W. S., Glenburnie-road, Mitcham ..	A, B	477
Poulton, A. W., Vickers-street, Sebastopol	A, B, C	2,321
Rae, J., Albert-street, Sebastopol ..	B, C	1,889
Ranleigh Poultry Farm (D. H. Tokimosa, Prop.), Dingley	A, B	743
Ridge and Son, 42 Myrtle-grove, Blackburn	A, B, C	3,045
Robinson, W., 11 Olive-street, Hampton ..	B, C	1,029
Rose, H., Yarrambat	B	583
Rowe, Mrs. L. M., "The Wattles," Wal Wal	A, B	319
Salmond, J. B., Deer Park	H	246
San Miguel, M. H. (Mrs.), Woodhouse-grove, Box Hill	A, B	1,896

(continued on page 324.)

PITTING DISORDERS IN PEARS

By C. E. Cole, B.Agr.Sc., Senior Horticultural Research Officer

Most fruitgrowers are familiar with bitter pit in apples, although it is seen less frequently nowadays than forty years ago, when David McAlpine was appointed by the Commonwealth Government to investigate its cause and control. Many, too, are aware that another kind of pitting in apples can be caused by an insufficiency of the plant food, boron, but this type occurs only rarely in Victoria. Pitting in pears is less familiar, but concern is felt at its increase in recent years. Apples and pears are closely related botanically; and this gives rise to an obvious question—are the pit disorders of the pear the same as those of the apple?

THE word "pit" in relation to fruit originally meant a depression in the surface. These depressions often had darker spots of flesh below them, as in bitter pit. Similar darker patches of flesh may occur anywhere in the fruit, with no corresponding depression on the surface. Thus the term "pit" has come to mean any small discoloured spot of flesh wherever it occurs. In apples, the injured flesh forming the pit usually dries out and becomes of a cork-like texture. In pears, the injured flesh more frequently forms "stone cells", so that the pits are often gritty or hard and woody.

BITTER PIT

No one has yet been able to find any insect, fungus, or virus or any deficiency or excess of plant food which is responsible for bitter pit in apples. It is usually considered to be due to some failure of the water distribution *within* the tree, and is called a *physiological disease.*

No similar trouble in pears has been positively identified in Victoria. McAlpine, in his reports on his investigations on bitter pit, refers several times to bitter pit of pears, but the photographs he gives are almost certainly of another trouble—stony pit—described below, and not of the same nature as bitter pit in apples.

In America, there occurs a pitting of some varieties of pears known as "cork spot" or "drought spot" and, as with bitter pit, no definite cause for it can be found. Possibly this is the corresponding disease in pears—if so, pears in Victoria do not seem much subject to it. It is described as brown corky spots near the surface of the fruit, which may be seen when the fruit is peeled, and developing late in the season. If severe, it may cause a bumpy appearance of the fruit surface. As stated, this type of pitting has not been of importance in Victoria.

Fig. 1—Boron-deficiency pitting of pears occurs in New South Wales. The pear is a Packham's Triumph.
[After N.S.W. Agric. Gazette.

BORON DEFICIENCY

Can a shortage of the element boron cause pitting of pears as it does in apples? It can and does, and such pitting has been reported from New South Wales and America. The pits at the surface are described as flat-bottomed. They occur mostly in the calyx end of the fruit.

Fig. 2—Stony pit can cause extreme malformation of pears as in these Packham's.

In New South Wales they are often associated with a roughening or cracking of the skin; in America, with a hardening and blackening of the flesh around the eye very much like "black-end" in Victoria. Of course the use of boron as a cure for true black-end has been well tried both here and overseas without success, and the disease black-end is still considered to be due to the use of certain rootstocks.

Some pears with roughened and cracked skins have been found in Victoria, and tests are in progress to discover whether boron deficiency is the cause. Pitting and blackening of the eye such as that described in New South Wales and America have not been found here. As cases of boron deficiency in the apple and other sensitive crops are rare in Victoria, trouble with the less sensitive pear should not be common.

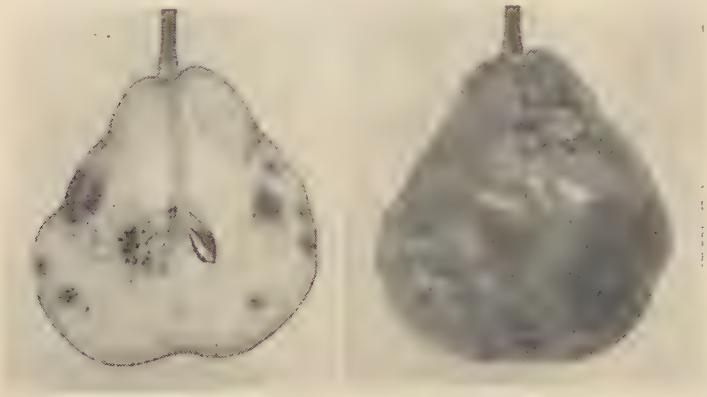


Fig. 3—Milder forms of stony pit make the fruit "bumpy". In section the pits show as brown to black spots.

HAIL MARKS

When a pear is half-grown or more and is hit by hail, the effects, in the shape of cuts and scars on the exposed side of the fruit, are usually unmistakable. If the pear is hit when younger, the smaller damaged spots may heal over, leaving only a shallow depression in the surface of the fruit. The absence of external scar tissue might suggest that the pit is not a hail mark. If the flesh below the depression is brown, spongy and dry, with no other pits in the flesh away from the skin, the injury is almost certainly due to hail.

STONY PIT

The commonest type of pitting in pears in Victoria seems to be the one known as "stony pit." The pits are brown to black, hard and stony, and the whole fruit sometimes woody, so woody as to be difficult to cut with a knife. The flesh has a bitter taste. The pits may occur just beneath the skin, or anywhere through the flesh and core.

Fruits affected when young may remain small, or grow one-sided, distorted, knobbled and pitted. Older pears will be merely dimpled on the surface. Occasionally fruits will show no external signs, but on cutting, the typical black hard spots in the flesh can be found. The illustrations describe best the appearance of pears affected with stony pit.

Usually the disease is found on the same few trees in the orchard. Some of these trees may show the pitting badly every year; some may show it some years and not others: some will have much badly pitted fruit, some will have only a few of their fruits slightly pitted. A single branch may be affected, or a whole tree.

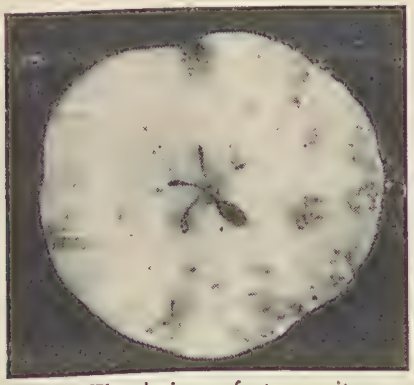


Fig. 4—The lesions of stony pit may occur anywhere in the flesh or core.

The varieties most commonly affected in Victoria are Josephine and Packham's Triumph, but trees of the present popular commercial varieties Winter Nelis, Beurre Bosc and Beurre d'Anjou, and several less common varieties, have been found with pitting of the stony pit type.

An examination of the occurrence of this disorder in Victoria lends support to the American and New Zealand findings that it is a virus disease which rarely, if ever, spreads in the orchard by natural means, but is transmitted by the use of buds or grafting scions from infected trees. Once a tree is infected, either by the bud in the nursery, or by reworking in the orchard with infected scions, no method of curing or controlling the pitting is known. Probably the best course is to remove the tree and plant a new one.

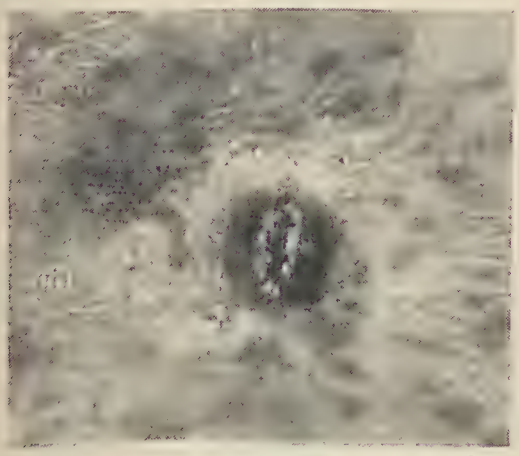


Fig. 5—A lithiasis pit magnified to show the pustule.

In America and New Zealand, it is recommended that affected trees be worked over to the variety W.B.C., which, in those countries, does not show the pitting. In South Australia, a similar recommendation is given, although it is known that the "Duchess," as W.B.C. is called in that State, will sometimes show stony pit when used for reworking other varieties affected by the disease. If this occurs, nothing remains but to grub the tree out.

Fig. 6—Lithiasis on W.B.C. pears shows as small depressions on the skin, often with a hard pustule at the bottom.

In Victoria, a few instances are known in which W.B.C. has shown a pitting almost certainly due to the stony pit virus, so that the reworking of other varieties with W.B.C. to overcome pitting is of doubtful value here. No other varieties suitable for the purpose are known.

Although natural spread does not seem to occur, there is always the possibility that some insect capable of transmitting the virus may appear. The safest course is to remove infected trees which could serve as a reservoir of the disease.

LITHIASIS

W.B.C. pears occasionally suffer a surface pitting called "lithiasis." It shows as a small depression in the skin, often with a little hard, rough dot at the bottom. Beneath the skin is a hard stony spot of tissue, light-brown or creamy in color. Usually only one or two pits occur on a fruit, but sometimes several may be found. They are always at the surface. Although not very noticeable, the pits are a source of loss in the canneries because they catch on the peeling knives and gouge out grooves in the flesh.

Fig. 7—Beneath the surface depressions are small masses of stony cells. In lithiasis these cells are never found away from the surface.

The occurrence of lithiasis seems to be scattered quite by chance. No particular reason can be assigned for it. In America, it is said to be more common in the drier fruit-growing districts. The same may be said of it here, for it has been observed only in the Goulburn Valley. No recommendation for its control can be given. On the other hand its occurrence has been so sporadic that there is little fear of its being an infectious disease. The writer would like to know of any orchard where lithiasis occurs regularly so that the problem may be investigated.

RECOMMENDATIONS

In view of the fact that the commonest type of pitting of pears in Victoria appears to be due to stony pit, which is transmissible by budding and grafting, the following recommendations are made:—

1. Buds or scions for propagating young trees in the nursery should *never* be obtained from pear trees on which the fruit has shown pitting *at any time* (other than that due to hail injury).

2. Similarly, buds or scions for reworking orchard pear trees should never be obtained from such trees.

3. If orchard trees bear pitted fruit, the advice of the district orchard supervisor as to the cause of the pitting should be sought. If it is considered to be stony pit, the safest course known at present is to remove affected trees and plant new ones.

Affected trees may be worked over to W.B.C. with the possibility of obtaining pit-free fruit. As stated earlier, this is by no means certain in Victoria. Conversely, since W.B.C. may carry the virus without showing pits, the reworking of W.B.C. trees to other varieties involves some risk that the new variety will be pitted.

Book Review

Sheepfarming Annual 1948, published by The Massey Agricultural College, New Zealand. 280 pp. Price 10s. N. Z. currency

This book, which includes the addresses given at the Eleventh Annual Meeting of Sheepfarmers held at Massey Agricultural College and at Napier during June, 1948, contains a wealth of information on sheep diseases and sheep husbandry.

Although most of the articles are written from the New Zealand angle, Australian farmers will find much to interest them. There are many excellent articles on all aspects of sheep farming, such as Power Spray Dipping, Infertility in Rams, Milk Supply of Romney Ewes, to mention only a few. Not the least interesting part of the book is the record of the general discussions which followed the various lectures.

[R. J. deC. T.]

Efficiency in Use and Control of Irrigation Water

Cobram Competition 1948-49

By H. B. Lincoln, C.E., A.M.I.E. (Aust.), Executive Engineer, State Rivers and Water Supply Commission

IRRIGATION in the Cobram area actually commenced in 1908, with the issue of a permit to Mr. H. Dick to irrigate 50 acres by pumping from the River Murray. Further extensions took place in 1915, when the Cobram Irrigation Company was formed and was granted an annual permit to irrigate 800 acres which later was extended to cover 1,300 acres.

The weir at Yarrawonga.

Many fine orchards were established on the area irrigated by the Cobram Irrigation Company, but, with the completion of the Yarrawonga Diversion Weir in 1939, and approval of the scheme to irrigate a large area of high-class land extending from the Parish of Boosey westerly to the Parish of Picola, the company requested the State Rivers and Water Supply Commission to supply water to the area covered by the permit. This was done, and the area in question became the first section of 269,000 acres now included in the Murray Valley Irrigation District to be irrigated.

Development of the area has followed closely on the completion of the channel system. Principal lines of production include canning fruits, dairying, wool growing, lamb raising, and vegetable growing.

The Cobram Agricultural Society, whose members are mainly situated in the earlier-developed portion of the district, this year conducted a competition for "The Farm with the Most Efficient Use and Control of Water". In accordance with its policy, the State Rivers and Water Supply Commission co-operated and donated a prize of 15 acre-feet of water to the winning competitor. If ten or more entries had been received, a second prize of 10 acre-feet of water would have been awarded. However, six entries only were received, but the standard was high in all cases.

The Cobram area has a number of advantages over the older-established irrigation districts. A complete soil survey was made by the Council for Scientific and Industrial Research and the Department of Agriculture in conjunction, and the result has been that irrigators have first-hand information on which to select the areas most suitable for any particular use. This survey has shown that the soils, on the

average, are more suitable for irrigation than in the neighbouring Goulburn Valley districts.

State Rivers and Water Supply Commission's engineers and surveyors have assisted to design and check layouts, and this has resulted in the elimination of many mistakes made in districts developed 30 years or more ago.

The Soldier Settlement area which, when fully occupied, will comprise some 60,000 acres within the Murray Valley Irrigation District, is being settled as fast as present-day conditions will permit, but none of the farms is yet sufficiently developed and operated to take part in a competition of this nature.

Judging was based on the methods used to ensure efficiency, and points were allotted as follows :—

Irrigation—Method of irrigation and layout of property, 25; methods of controlling water, 15; cleanliness of channels, 15	55
Drainage facilities and cleanliness of drains	25
Provision of water for stock, 10; record of waterings, 10	20
	100

The layout for irrigation in the farms inspected was excellent, with very few defects. In one case, points were lost because the length of bays was somewhat long, and, in another, on account of the command or head channel being rather small. However, but for this exception, entrants were aware of the benefit of having their channels large enough to hold a good head of water. They had constructed good-sized scooped channels for their main channels, using the delver only for spur channels where the quantity of water required was comparatively small.

Attention had also been given to the construction of permanent structures in concrete. The "mud bank" in such common use in older-established districts was conspicuous by its absence. Care had been taken to fit the checks with water-tight steel doors or wooden-drop bars. These are important factors in the control of irrigation water.

Channels generally were clean, free of weeds, and in good hydraulic condition, the main implement of maintenance being the shovel.

The absence of a comprehensive drainage system has made the irrigators careful in the use of water, with a minimum of waste. All have good provision for drainage, and, in all but one case, the outfall is to natural features or to the road drain.

One of the competitors has a very good system of drains which outfall to a low part of his block which is used as a dump for excess water. This low portion is sown down mainly to paspalum and white clover, with results indicative of what may be done in many similar cases.

All competitors had made good and complete provision for stock waterings, either by earthen storage tanks or windmill, overhead tanks, and troughs.

The keeping of records, due probably to the influence of previous competitions, was given attention by three of the competitors. In one case the irrigator had

Grading irrigation land preliminary to banking.

prepared plans of his block, one for use by the water bailiff. On this plan, the paddocks are numbered and, when water is ordered, the bailiff is informed what paddocks require it. Particulars are noted on the plan; and, in the other cases, a diary is kept.

The keeping of records, once started, is not a very long or onerous job, and enables the irrigator to detect weaknesses and effect improvements where necessary, especially if linked up with the different agricultural operations such as seeding, manuring, cutting, and cultivating.

In the Northern District irrigation country.

The entry placed first in the competition (that of Mr. R. Cornish) is a block of 180 acres. One hundred and twenty acres is in fruit, mostly canning varieties, and the balance in pastures. A feature of the layout is the close attention given to the length of runs which vary according to the many soil types. In the case of the lightest soil (Sandmount Sand) the length of furrows is restricted to 3 chains; the lengths on other and heavier types have been adjusted and lengthened accordingly.

Another interesting feature is an excavated tank concrete-lined for the storage of water for spray purposes with windmill and overhead tank. On the whole, Mr. Cornish's block is an excellent example of irrigation layout. The structures are neat and the checks fitted with steel doors. The block is well worth inspection.

The points secured by each competitor are set out in the table.

CONTROL OF WATER COMPETITION—COBRAM IRRIGATION DISTRICT, 1948–49.

List of Awards.

Competitor.	Area Acres.	Water Supply.		Cleanliness of Channels.	Drainage.	Water Supply for Stock.	Records of Waterings.	Total
		Layout.	Structures.					
Possible points ..	..	25	15	15	25	10	10	100
R. Cornish ..	177	24	15	13	20	10	7	89
E. R. Ennals ..	119	22	12	12	22	10	9	87
J. V. Bourchier ..	113	23	13	11	20	10	5	82
W. Murch	249	22	15	14	20	10	..	81
C. Dick	492	23	13	12	20	10	..	78
F. N. Harris ..	228	20	10	10	20	10	..	70

CERTIFIED ONION SEED

List of Growers for 1948-49 Season

By R. Henderson, B.Agr.Sc., Horticultural Instructor

A marked improvement in the quality of long-keeping onion varieties coming forward from the Western District has been noted by export buyers and others in the trade. The improvement, which applies particularly to the variety Australian Brown, is attributed by the Department largely to the use of certified onion seed. Lines produced by Western District growers are showing greater uniformity in shape, and considerably less Red Rocca—a red pigmentation in brown onions.

These qualities are appreciated by local and export buyers who look to Victoria for large quantities of long-keeping onions. Growers throughout Victorian onion-growing areas are urged by the Department to sow certified seed only. By so doing they will grow a better crop and also help maintain the overseas demand for high-quality Victorian onions.

Certified seed, which is grown under the supervision of Departmental officers, may be readily identified by the blue label of certification on the sealed bag. Seed-cleaning operations have been completed and supplies of 1948–49 seed are available from the growers listed in the accompanying table.

Grower's Name.	Address.
AUSTRALIAN BROWN	
1. Burns, A.	Corunnun
2. Carmody, E. P.	Cororooke
3. Carmody, J. J.	Warrion
4. Carmody, M.	Cororooke
5. Finley, E.	Cororooke
6. Henderson, J.	Portarlington
7. Hutchinson, W. A. and Sons	Drysdale
8. Hutchinson, J. B. ..	Drysdale
9. Kahl, Magnus	Murghelbouc
10. Lindsey, P. H.	Woodford
11. Lupino, G. A.	Warrion
12. O'Shannassy Bros. ..	Cororooke
13. Roache, J. J.	Nalangil
14. Sheehan, W. H. ..	Killarney
BROWN GLOBE	
1. Burns, A.	Corrunun
2. Camm, E. A.	Becac
3. Carmody, E. P.	Cororooke
4. Carmody, J. J.	Warrion
5. Finley, E.	Cororooke
6. Lindsey, P. H.	Woodford
7. Morrissy, J. P.	Alvie
8. O'Shannassy Bros. ..	Cororooke
9. Sheehan, W. H.	Killarney
IMPERIAL WHITE SPANISH	
Henderson, J.	Portarlington

CERTIFIED PULLORUM-TESTED FLOCKS (POULTRY)—*(continued from page 316).*

Owner.	Breed.	Number of Birds.
Scales, J., West Wattle Tree-road, Boronia..	A	1,492
Settle, J. H., Stanhope	A, C	2,491
Simpson, G. D., May-road, Glen Waverley ..	B	2,928
Smith, A. W. and M. P., Terang Poultry Farm, Terang	B	969
Smith, H. A., Marong-road, Maiden Gully ..	A, B, C	1,196
Snodgrass, R., Pakenham East	B	1,352
State Research Farm, Werribee	A, B	2,062
Stewart, J., Maldon-road, Castlemaine ..	A, B	565
Stewart, P. D., Bayswater-road, Croydon ..	A, B	1,028
Streeter, H. A., Avoca	B	508
Swift, D. A., Kangaroo Flat	A, B	2,313
Taylor, H. L., 180 Surrey-road, Blackburn..	A, B	1,389
Taylor, H. R., Rosebank Poultry Farm, Reservoir	A, B, C	5,357
Taylor, R. H., 132 Rathgowan-road, Reservoir	A, B, C	3,730
Teitz, G., 21 Kingsley-crescent, Mont Albert	B	736
Thomson, S. R., Bacchus Marsh-road, Corio	A, B, C	1,543
Voigt, A. H., Sunnyside Poultry Farm, Follett-road, Cheltenham	A, B	1,412
Walton, F. R., Woodvale-road, Boronia ..	A, C	707
Wandong Poultry Farm (Mrs. M. E. Trembath), Lawn-road, Noble Park	A, B	1,512
Webb, A. E. H., Frankston-road, Cranbourne	A, B	5,653
Welch, T. A., Bayswater-road, Croydon ..	A, B	3,062
Wesley, J. H., "Fairview," Kangaroo Flat	A, B, C	1,210
Winter, G. A., "Denehurst," Murghebolue	A, C	355

Garden Notes for August

By George Hyam, Horticultural Supervisor

THE FLOWER GARDEN

Trees and Shrubs

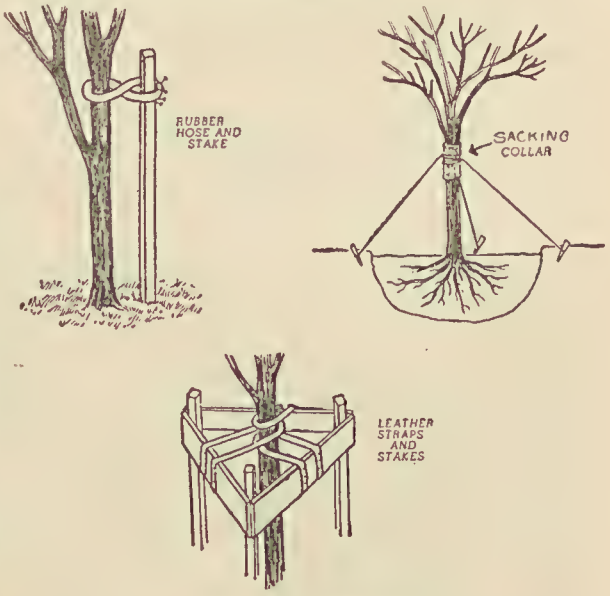
ALTHOUGH evergreen trees and shrubs can be planted at other times if raised in pots and where ample watering facilities are available, August and September are the best months for planting an assortment of different species.

The ground should be dug over at least a fortnight before planting to give the soil a chance to settle and, if the subsoil is hard and the topsoil shallow, trench deeply, not merely for a few inches round the planting site, but over the whole bed in the case of a shrubbery or where flowers are to be grown between the trees, and for a distance equal to the eventual spread of the branches in the case of specimen trees. This allows the roots to descend and this deep-rooting makes them less subject to the effects of drought conditions. Further, if ornamental shrubs are to be interplanted with flowers, there will be much less competition if the roots of trees and herbaceous plants are at a different level. On the other hand, digging a deep, small pot-hole for the purpose of planting a shrub in a mixed garden, merely makes a drainage sump for the surrounding undisturbed area.

Very few shrubs or trees will flourish in badly-drained soils or where the permanent water-table is less than three feet from the surface.

No manure or fertiliser should be applied when planting—any feeding is better done by surface applications when the trees are thoroughly established.

The planting hole in the prepared bed, should be just large enough to accommodate the roots of the nursery plant. Use small stakes for all but the bushy dwarf shrubs as temporary support for those of medium height. More permanent and larger stakes will be needed for the tall growers. Wind vibrating newly-planted trees can cause slow and abnormal rooting development or can even prevent rooting entirely. By keeping the leading shoots tied to the stake in an upright direction for the first year or so, growth will be quicker and shape will be normal. Bushy shrubs are best supported by ties from their trunk to three or four pegs inserted in the ground, tent-peg fashion, or by surrounding them with a screen of hessian fixed to four garden stakes. The last method is also used to temporarily protect trees like jacarandras or kalmias which are subject to frost or hot-wind damage in their juvenile stage.

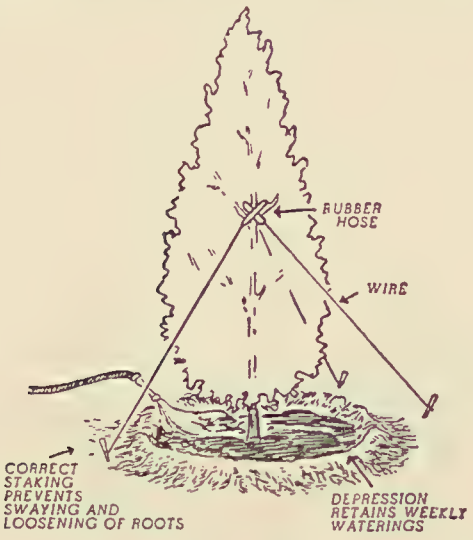


Methods of staking trees.
[After Wilkinson.

Planting Shrubs from Pots or as Balled Plants

Nursery shrubs in pots should be tipped out with the ball of roots intact. Remove the drainage material and then pull out the lowest roots which may have travelled round the sides of the pot. If the shrub is planted without spreading the ends of the main roots outwards, they may continue to grow in a circular direction, causing a condition known as "girdling" which, in effect, is similar to a pot-plant becoming pot-bound. Otherwise, the less disturbance

of the fibrous roots the better. For balled plants with the roots encased in sacking, place in a bucket of water before planting so that the ball of earth is thoroughly soaked. There is some difference of opinion as to whether it is better to plant with the cover on or not. The best way is to be guided by the nature of the ball; if the soil within the cover feels hard, the cover is best removed; if the soil is sandy or friable, it is better not to remove the cover.



Staking and watering tree.
[After Wilkinson.

Many flowering deciduous shrubs are sold in pots when in bloom and these are quite satisfactory to plant out, but when the flowers fade, it is better to cut them back so as to shape them and to promote new branches as well as more flowering wood for the following season.

After the tree or shrub has been placed in the planting hole, fill in the covering soil in layers, tamping each layer firmly around the roots and finally giving the soil a good drenching with water to eliminate air-pockets. All shrubs are best planted a little deeper than they were in the nursery, and the final soil level around should be in the shape of a saucer-like depression for watering purposes until they become established.

All young trees require frequent watering during the first spring and summer unless heavy rains occur. This would be equivalent to at least a gallon per week for each young tree for the first few weeks, gradually increasing the intervals between watering so as to acclimatise it to drier conditions. After the first year, ordinary normal garden watering or less is more desirable. Even in dry areas where little water is available, there are many subjects that will grow with natural rainfall after the first year if the surface is adequately mulched. Trees which have been regularly watered and then have to meet a dry period often perish, while those which have been conditioned to drier conditions survive.

Pruning Trees and Shrubs

Most garden shrubs and trees require thinning and light pruning. The majority of our flowering species produce flowers on new wood which should be encouraged. Any pruning should be in the nature of a trimming applied so as to preserve the natural shape of the species which gives a more pleasing effect than the formal shapes with most of them. Times of pruning vary, but generally the best time is immediately after flowering or berrying. For most evergreens, August is a favourable period.

Unwanted growth on young trees or shrubs is best removed by rubbing off the shoots as soon as they appear at any month in the year. Heavy topping or pollarding to restrain the height of trees is best done in August for evergreens and June/July for deciduous kinds. Any branch cut back over an inch or so in diameter should have the cut painted over with thick paint or Stockholm tar to prevent fungal rots entering. Any other pruning cuts should be made close to a bud and in a slanting direction as for fruit trees or roses without leaving a stub of bud-less wood which will inevitably die back and probably induce decay. Some species, as for instance, lilacs and crepe-myrtles (*lagerstroemia*), flower on biennial or older wood, so that the pruning of these is light in any one year.

A general principle in regard to maintaining shape is to prune side branches for upright growth and to remove the main leader to make it spread more widely. Excessive cutting of established trees at any one time encourages suckering or water shoots in many species. Suckers should be twisted off—not cut—as soon as they appear, and while still green and sappy. No tree prone to root suckering should be planted in small gardens.

Raising Tomato Seedlings

August is a good time to start to sow tomato seeds without heat in most districts and the home gardener will find that this is the most satisfactory way to produce seedlings for planting out later. They will be hardier if not forced, as are most of the seedlings offered for sale. The average small garden only needs a few plants, and it is preferable to make three plantings of early, mid-season and late varieties respectively. For such small quantities, the seed can be sown in five or six inch flower pots or in boxes.

The soil, which should be of light texture such as a sandy loam, is best sterilized before sowing. A small quantity can be treated by pouring boiling water on to it or alternatively, by baking in an oven. Add the lightest possible dusting of super phosphate, and sieve the soil. Provide good drainage, using at least an inch of broken crock or gravel at the bottom of the container. It is better to place each seed in position on the surface with tweezers, using about 15 seeds to a five inch pot. This will avoid the necessity for pricking out later, and they can be grown on to planting-out size in the seed containers. Cover the seed with sieved soil and place a sheet of glass on the top of the pot or box.

Until the seeds germinate, the seed containers can be kept inside on a warm window-sill, but after that, hardier plants will be obtained if the containers are placed in the open, except that if frost is expected or heavy rains occur, they will need covering.

Growth will not be fast but the plants will be ready for planting in late October and the 15 seeds can generally be relied upon to produce at least 12 sturdy plants.

Other August Work

The first of the successional sowings of root crops are made in August, but these are usually only sufficient to keep a continuous supply from the time the summer and autumn sown crops finish, until the main spring sowings are ready.

Last season's roots will go to seed in late September and these should be lifted at the end of August and stored in boxes of sand. They can thus be kept for use until the August sowings are ready, which will be from November onwards.

A liberal sowing of beetroot can be made now as it is mainly in the warmer months that these are required, and beetroot can be held in the ground through the summer.

Early sown carrots are subject to attack by aphis and virus which these insects convey, but the West Australian variety "Osborne Park" and various selections of it have shown a high resistance to virus and can be recommended for present sowing.

Other carrot varieties can be planted if the grower is prepared to keep down the aphis by dusting, and one of the best of the less virus-resisting types for August planting is the Early Scarlet Short Horn. This matures earlier and as it has short stumpy roots, it is particularly suitable for heavy or shallow soils.

Early Wonder beetroot also matures earlier than other varieties. Those who wish to raise either asparagus or rhubarb from seed will find that August is a good month to sow these. Other August sowings comprise Greenfeast peas; broad beans in districts south of the Divide or in high country; silver beet; Chinese cabbage; leeks and celery for summer planting out and successional crops of lettuce and radish. The planting list includes seedlings of late onions, potatoes, spring lettuce, Jerusalem artichokes and herb plants.

LIST OF STOCK FOODS AND STOCK LICKS

REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE STOCK FOODS ACT 1936 (No. 4382) FOR THE YEAR 1949.

Distinguishing Brand Name.	Guaranteed Composition.			Where Obtainable.
	Crude Protein (N x 6·25). Minimum.	Crude Fat. Minimum.	Crude Fibre. Maximum.	
CONCENTRATED STOCK FOODS.	%	%	%	
* *Feeding Blood Meal.*				
Imperial	85·0	..	5·0	W. Angliss and Co. (Aust.) Pty. Ltd., Lynch-street, Footscray
Pannifex	75·0	2·0	5·0	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
Champion Protein	75·0	..	5·0	Sims Cooper Freezing Works Pty. Ltd., 31 Queen-street, Melbourne
Brooklyn, T. B. and S. in diamond	75·0	1·5	1·0	Thos. Borthwick and Sons (A/asia) Ltd., 84 William-street, Melbourne
Portland, T. B. and S. in diamond	75·0	1·5	1·0	" " " " " "
V.I.M.A.	80·0	..	1·5	Victorian Inland Meat Authority, 54 Market-street, Melbourne
† *Feeding Meat Meal.*				
M.C.C. (with bone)	57·0	10·0	5·0	Melbourne City Council, Town Hall, Melbourne
Imperial Liver Meal	65·0	18·0	..	W. Angliss and Co. (Aust.) Pty. Ltd., Lynch-street, Footscray
Pannifex	55·0	5·0	3·0	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
V.I.M.A.	55·0	13·0	1·6	Victorian Inland Meat Authority, 54 Market-street, Melbourne
Champion Protein Liver Meal	60·0	20·0	5·0	Sims Cooper (Freezing Works) Pty. Ltd., 31 Queen-street, Melbourne
A.B.C. Fish Meal	64·0	4·0	2·0	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
‡ *Feeding Meat and Bone Meal.*				
V.I.M.A.	45·0	12·0	1·5	Victorian Inland Meat Authority, 54 Market-street, Melbourne
Mercury	50·0	12·0	1·5	Process Refiners Pty. Ltd., 55 Hobson's-road, South Kensington
Pannifex	45·0	5·0	5·0	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
Imperial Protein	50·0	8·0	2·0	W. Angliss and Co. (Aust.) Pty. Ltd., Lynch-street, Footscray
Cal-Phoric	45·0	15·0	2·5	Mulgrave By-Products Co., North-road, East Oakleigh
Champion Protein	50·0	12·0	5·0	Sims Cooper Freezing Works Pty. Ltd., 31 Queen-street, Melbourne
Pioneer, No. 2	45·0	10·0	2·0	J. Cockbill, Footscray-road, Footscray
T.B. and S. in diamond Brooklyn	50·0	12·0	4·0	Thos. Borthwick and Sons (A/asia) Ltd., 84 William-street, Melbourne
Dandy	45·0	12·0	1·66	Gippsland Co-op. Bacon Curing Co. Ltd., Dandenong
Pridham's	45·0	12·0	1·0	W. Pridham Pty. Ltd., Evans-street, Braybrook
Pennell's	50·0	6·0	4·0	G. W. Pennell, Burke-street, Braybrook
Ibis	45·0	10·0	3·0	Ficken, Halliday, and McClelland Pty. Ltd., 634 Bourke-street, Melbourne
M.S.C.	50·0	10·0	3·5	The Mildura Shire Council, Mildura
Portland, T. B. and S. in diamond	50·0	12·0	4·0	Thos. Borthwick and Sons (A/asia) Ltd., 84 William-street, Melbourne
A.B.C. No. 3	48·0	9·0	3·0	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
Bone and Meat Meal.				
Kitchens	40·0	7·0	2·5	J. Kitchen and Sons Pty. Ltd., Ingles-street, Port Melbourne
J.K.S.	40·0	7·0	2·5	
Pannifex	40·0	5·0	5·0	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
Apex	40·0	10·0	3·0	North-Eastern Bone Products, Wangaratta
Milk Products.				
Krafco (Dried Whey)	10·0	0·5	..	Kraft Walker Cheese Co. Pty. Ltd., Riverside-avenue, South Melbourne
Kraftone (Dried Whey)	10·0	0·5	..	" " " " " "
Lactokraft (Dried Whey)	10·0	0·1	..	" " " " " "
Maffco Buttermilk Powder	30·0	5·0	..	Maffra Co-op. Milk Products Co. Ltd., Maffra
K.B.F. Buttermilk Powder	30·0	6·0	..	Korumburra and District Co-op. Butter Factory and Trading Co. Ltd., Korumburra
Acme Buttermilk Powder	30·0	7·0	..	Warrnambool Cheese and Butter Factory Co. Ltd., Allansford
Milway Milk Product	20·0	18·0	1·5	Kraft Walker Cheese Co. Pty. Ltd., Riverside-avenue, South Melbourne
Colac Dried Milk Albumen	54·0	5·0	0·2	Colac Dairying Co. Ltd., Colac

* Standard not less than 75 per cent. crude protein and not more than 5 per cent. crude fibre.

† Standard not less than 55 per cent. crude protein and not more than 7 per cent. phosphoric acid. 100 per cent. must pass through a 10-mesh sieve.

‡ Standard not less than 45 per cent. crude protein. 100 per cent. must pass through a 10-mesh sieve.

Distinguishing Brand Name.	Guaranteed Composition.			Where Obtainable.
	Crude Protein (N x 6·25). Minimum.	Crude Fat. Minimum.	Crude Fibre. Maximum.	
CONCENTRATED STOCK FOODS—*continued.*	%	%	%	
Oil-Seed or Cake Meals and Nuts.				
Eta Peanut Meal	45·0	2·0	6·0	Nut Foods Pty. Ltd., 271 Grant-street, South Melbourne
Meggitt's Linseed Oil Meal	28·0	5·0	10·0	Meggitt Ltd., Hobson's-road, South Kensington
Meggitt's Linseed Sheep Nuts	28·0	5·0	10·0	" " " " "
Barnes' Linseed Oilmeal	33·0	2·0	10·0	James Barnes Pty. Ltd., Bank-place, Melbourne
Barnes' Coconut Oilmeal	21·0	1·5	12·0	" " " " " "
MIXED STOCK FOODS.				
For Pigs.				
Barastoc Pig Cubes	15·0	3·0	6·0	Barastoc Products, 395 Collins-street, Melbourne
Barastoc Topping-off Pig Cubes	12·5	3·0	6·0	" " " " "
Osmond's Codlivine (Pigs)	19·0	13·0	9·0	Osmond and Sons (Aust.) Pty. Ltd., 35 William-street, Melbourne
Clark's Pig Starter	17·0	4·0	6·0	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Clark's Gro-Pig	16·0	3·0	4·0	" " " " "
Cohana Pig Meal	15·0	2·0	7·0	Cohana Stockfood Co., Shed No. 9, Williamstown Pier
Hutmill Pig Meal	14·0	2·5	7·5	Hutchinson's Finley Flour Milling and Agency Co. Pty. Ltd., Glenroy
For Calves.				
Harper's Star Calf Food	12·0	12·5	7·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
*Parsons' Calf Food	12·0	2·0	6·0	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Ayrshire Calf Food	13·3	2·45	4·0	James Railton, 133 Elizabeth-street, Melbourne
Ward's Calf Food	9·0	3·0	7·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Vetamac Calf Food	15·35	7·5	1·5	A. H. McDonald, 627 Bridge-road, Richmond
Velox Calf Food	14·5	2·9	4·0	H. C. Allen, Newcombe-street, Portarlington
Gro-calf	20·0	4·0	4·0	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Kaf-o-vite	16·5	9·5	7·5	Goldsbrough, Mort, and Co. Ltd., 526 Bourke-street, Melbourne
Barastoc Calf Pellets	17·0	4·0	6·5	Barastoc Products, 395 Collins-street, Melbourne
Federal	20·4	8·2	5·1	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
Taylor's Calf Food	14·0	2·6	4·6	National Cattle and Poultry Food Co., 75 Francis-street, Melbourne
Rudduck's Calf Food	17·0	2·3	3·5	Rudduck and Co. Pty. Ltd., 556 Lonsdale-street, Melbourne
Champion Calf Food	12·0	5·0	5·0	Werona Products, 592 Burwood-road, Auburn
P. and F. Competition Calf Food	17·0	6·0	4·0	Poultrymen and Farmers Trading Co., 276 Queensberry-street, North Melbourne
Buchanan's Calf Food	22·0	8·0	6·0	D. G. Officer Pty. Ltd., 90 William-street, Melbourne
Hutmill Calf Food	13·0	4·0	10·0	Hutchinson's Finley Flour Milling and Agency Co. Pty. Ltd., Glenroy
For Dairy Cows.				
Lambert's Dairy Mixture No. 3	15·0	5·0	8·0	T. H. A. Lambert Pty. Ltd., 696 High-street, Kew
Barastoc Dairy Cow Cubes	14·0	3·5	10·5	Barastoc Products, 395 Collins-street, Melbourne
Barastoc Dairy Cow Meal	14·0	3·5	10·5	" " " " "
Mormilk No. 2	20·0	4·75	14·0	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
Clark's Dairy-Mex	18·0	3·0	8·0	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Cohana Blended Cow Feed	11·0	2·5	7·0	Cohana Stockfood Co., Shed No. 9, Williamstown Pier
*Parsons' Dairy Cow Meal	17·0	3·5	17·0	Parsons Bros. and Co. Pty. Ltd., 554 Flinders-lane, Melbourne
P. and F. Dairy Cow Meal	15·0	8·0	11·0	Poultrymen and Farmers Trading Co., 276 Queensberry-street, North Melbourne
Champion Cow Meal	15·0	5·0	11·0	Werona Products, 592 Burwood-road, Auburn
Hutmill Dairy Meal	17·0	3·0	8·0	Hutchinson's Finley Flour Milling and Agency Co. Pty. Ltd., Glenroy
General.				
Osmond's Codlivine	20·0	13·0	9·0	Osmond and Sons (Aust.) Pty. Ltd., 35 William-street, Melbourne
Cowling's Proteinized Ground Wheat	13·0	2·5	6·0	W. Cowling, Market Square, Bendigo
Purity Stock Meal	15·0	3·0	5·0	Wise Bros. Pty. Ltd., 530 Collins-street, Melbourne
Cohana Universal Pellets	16·0	3·0	5·0	Cohana Stock Food Co., Shed No. 9, Williamstown Pier
Parsons' Stock Mixture	15·0	6·0	16·0	Parsons Bros. and Co. Pty. Ltd., 554 Flinders-lane, Melbourne
Barastoc Sheep Maintenance Cubes	14·5	3·0	9·0	Barastoc Products, 395 Collins-street, Melbourne

* Contains 1 per cent. salt.

Distinguishing Brand Name.	Guaranteed Composition. Crude Protein (N x 6·25). Minimum.	Crude Fat. Minimum.	Crude Fibre. Maximum.	Where Obtainable.
MIXED STOCK FOODS—*continued.*	%	%	%	
Poultry Foods.				
Harper's Prepared Grain	8·5	8·0	4·5	Robert Harper and Co. Ltd., 390 Flinders-lane Melbourne
Clark's Laymor	17·0	4·0	6·0	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Clark's Gro-chick	16·0	4·0	6·0	" " " " " "
Eggoleen	40·0	10·0	3·0	" " " " " "
Clark's Chick-starter	17·0	4·0	6·0	" " " " " "
Clark's Turkey Starter	18·0	4·0	6·0	" " " " " "
Clark's Breeders' Mash	16·0	4·0	6·0	" " " " " "
Clark's Fatner	14·0	4·0	6·0	" " " " " "
Warragul Laying Mash	14·0	4·5	4·2	Warragul Egg Circle, Warragul
Warragul Growing Mash	14·7	5·9	5·2	" " "
Cowling's Laying Mash	14·0	2·5	7·0	W. Cowling, Market Square, Bendigo
Cowling's Chick Mixture	10·0	1·25	3·0	" " " "
Cowling's Chick Starter	15·5	3·0	5·0	" " " "
Cowling's Growing Grain	12·0	1·5	4·0	" " " "
Barastoc Poultry Pellets W (Layers)	16·0	4·0	7·0	Barastoc Products, 395 Collins-street, Melbourne
Barastoc Chick Pellets	17·0	4·5	7·0	" " " " "
Barastoc Poultry Grower's Pellets A	14·0	4·0	7·0	" " " " "
Barastoc Poultry Pellets W (Growers)	14·0	4·0	7·0	" " " " "
Barastoc Poultry Layers' Pellets	16·0	4·0	7·0	" " " " "
Ward's Chick Meal	10·0	4·0	5·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Osmond's Codlivine for Poultry	19·0	12·0	9·0	Osmond and Sons (Aust.) Pty. Ltd., 35 William-street, Melbourne
Excello Growing Mash	9·0	3·4	7·0	Lyall and Sons Pty. Ltd., 39–51 Leveson-street, North Melbourne
Excello Laying Mash	13·0	4·0	7·0	" " " " " "
Clark's Vitamilk	31·0	6·0	1·0	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Mercury Poultry Food Concentrate	29·0	5·0	2·0	Process Refiners Pty. Ltd., 55 Hobson's-road, South Kensington
Lambert's Chicken Starter	17·0	4·0	6·0	T. H. A. Lambert Pty. Ltd., 696 High-street, Kew
Lambert's Laying Mash	17·0	4·0	6·0	" " " "
Cohana Blended Poultry Food	15·0	2·5	4·5	Cohana Stockfood Co., Shed No. 9, Williamstown Pier
A.B.C. Growing Mash	14·0	4·0	5·3	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
A.B.C. Laying Mash	16·0	3·5	7·0	" " " " " "
A.B.C. Werribee Mash	11·0	3·5	4·5	" " " " " "
Marvel Laying Mash	15·0	2·4	6·0	J. McBeth, 207 Neerim-road, Carnegie
Marvel Chick Mash	16·0	4·0	6·0	" " " " "
Marvel Growing Mash	16·0	4·0	6·0	" " " " "
Par-Meal Special Laying Mash	15·0	4·25	5·5	Parsons Bros. and Co. Pty. Ltd., 554 Flinders-lane, Melbourne
Parsons' Poultry Mash	16·0	8·0	11·0	" " " " " "
Parsons' Special Chick Mash	14·0	4·0	7·0	" " " " " "
Cole's Chick Food	13·6	2·9	5·0	Cole's Poultry Farm, Carlsbrook
Gem Laying Mash	16·0	4·0	9·0	Burrows Hume Flour Mills, Albury
Gem Chicken Mixture	10·0	2·0	4·0	" " "
Pannifex Poultry Pusher	32·0	7·0	8·0	H. C. Pannifex and Co. Pty. Ltd., 53 Munster-terrace, North Melbourne
V.W.C. Growing Mash	13·0	3·75	5·5	Victorian Wheatgrowers Corp. Ltd., 17 Queen-street, Melbourne
V.W.C. Laying Mash	17·0	2·0	2·5	" " " " " "
V.W.C. Chick Starter	16·0	2·25	4·0	" " " " " "
V.W.C. Kibbled Maize and Wheat	9·25	1·6	3·0	" " " " " "
P. and F. Special Chick Mixture	12·0	3·5	6·0	Poultrymen and Farmers Trading Co., 276 Queensberry-street, North Melbourne
P. and F. Competition Laying Mash	18·0	5·0	6·5	" " " " " "
P. and F. Growing Mash	14·0	4·0	5·5	" " " " " "
P. and F. Competition Laying Pellets	18·0	4·5	7·0	" " " " " "
P. and F. Competition Grow Pellets	14·0	4·0	6·0	" " " " " "
P. and F. Competition Chick Pellets	16·0	4·0	6·5	" " " " " "
Champion Laying Mash	16·0	5·0	7·0	Werona Products, 592 Burwood-road, Auburn
Hutmill Growing Mash	16·0	3·0	7·0	Hutchinson's Finley Flour Milling and Agency Co. Pty. Ltd., Glenroy
Hutmill Laying Mash	17·0	3·0	7·0	" " " " " "
Hutmill Chicken Mixture	10·0	2·4	2·0	" " " " " "
Bush's Laying Mash	14·9	3·9	7·2	Albert Bush, Williamson-street, Bendigo
Bush's Chick Mash	15·4	3·6	6·9	" " " "
Evans' Chick Feast	20·0	5·0	5·0	Evans' Grain and Produce Co., Carrier-street, Benalla
J (in shield) Chick Grain	11·0	4·5	5·5	O. W. Jochinke Pty. Ltd., Wimmera-street, Dimboola
Sergeant Dan Laying Pellets	16·0	4·5	7·0	Creamoata Ltd. Sunshine-road, West Footscray
Sergeant Dan Growing Pellets	14·0	4·5	7·0	" " " " "
Sergeant Dan Chick Pellets	16·0	4·5	7·0	" " " " "
V.W.C. Chicken Mash	14·5	4·3	3·6	Victorian Wheatgrowers Corporation Ltd., 17 Queen-street Melbourne

Distinguishing Brand Name.	Guaranteed Composition.			Where Obtainable.
	Crude Protein (N x 6·25). Minimum.	Crude Fat. Minimum.	Crude Fibre. Maximum.	
WHEAT AND WHEAT BY-PRODUCTS.	%	%	%	
Lyall's Wheat Meal	9·0	3·0	4·0	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne
Clark's Wheat Meal	9·0	1·0	3·0	Clark, King and Co. Pty. Ltd., 237 Queen-street, Melbourne
Pratt's Ground Wheat	9·5	1·5	3·5	David Pratt and Sons, Mair-street, Ballarat
Connell's Wheat Polishing No. 1	14·0	4·0	3·5	John Connell and Co. Ltd., 578 Bourke-street, Melbourne
Connell's Wheat Polishing No. 2	13·5	5·0	9·0	,, ,, ,, ,, ,, ,,
Maryborough Crushed Wheat	9·5	2·0	2·5	Maryborough Flour Mills Pty. Ltd., Maryborough
Wangaratta Crushed Wheat	8·5	1·5	2·5	Wangaratta Flour Mills Co. Pty. Ltd., Wangaratta
Water Wheel Ground Wheat	9·5	1·5	2·5	Water Wheel Flour Mills Pty. Ltd., 83 William-street, Melbourne
Darling's Wheat Meal	10·5	2·5	3·5	John Darling and Son, 44 King-street, Melbourne
Garden City Stock Meal	9·6	1·5	2·5	Garden City Flour Mill, Ballarat
Kimpton's Crushed Wheat	8·5	1·5	3·0	W. S. Kimpton and Sons, 395 Collins-street, Melbourne
McLennan's Wheat Meal	8·5	1·5	3·0	McLennan and Co. Pty. Ltd., Mooroopna
Willis' Wheat Stock Feed	9·5	2·0	3·0	Willis Bros., Kyneton
Minifie's Ground Wheat	9·0	1·5	3·0	Jas. Minifie and Co. Pty. Ltd., 422 Collins-street, Melbourne
Stratton's Wheat Meal	9·5	2·0	3·0	Stratton and Co. Pty. Ltd., 68 Lulie-street, Abbotsford
Cowling's Ground Wheat	9·5	2·0	2·5	W. Cowling, Market Square, Bendigo
Noske Crushed Wheat	9·5	2·0	2·5	Noske Flour Mills Pty. Ltd., 108 Queen-street, Melbourne
Schutt and Barrie Stock Meal	9·5	2·0	2·5	Schutt and Barrie Flour Mills Pty. Ltd., Sunshine-road, West Footscray
Thomas' Crushed Wheat	9·5	2·0	2·5	W. C. Thomas and Sons Pty. Ltd., 55 William-street, Melbourne
Hutmill Wheat Meal	9·5	2·0	2·5	Hutchinson's Finley Flour Milling and Agency Co. Pty. Ltd., Glenroy
Gem Stock Meal	9·0	2·0	3·5	Burrows Hume Flour Mills, Albury
Lambert's Wheat Meal	9·5	2·0	2·5	T. H. A. Lambert Pty. Ltd., 696 High-street, Kew
Williams' Rolled Wheat	9·5	2·0	2·5	Henry E. Williams and Sons Pty. Ltd., 9 High-street, Maryborough
Parsons' Wheat Polishings	13·5	3·75	5·5	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Morgrain Wheat Meal	9·5	1·5	2·5	Norris and Wilkinson, Tinning-street, Brunswick
Williams' Rolled Wheat Meal	9·5	1·5	3·0	Henry E. Williams and Sons Pty. Ltd., Maryborough
Marvel Wheat Meal	9·5	2·0	3·5	J. McBeth, 207 Neerim-road, Carnegie
A.B.C. Wheat Meal	9·0	3·0	4·0	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
Grant and Wilson Crushed Wheat	8·5	1·5	2·5	Grant and Wilson, Yarrawonga
Tomlins Simmie Ground Wheat	9·5	2·0	2·5	Tomlins, Simmie and Co., Bendigo
Lanray Wheat Polishings	16·0	5·0	7·0	Lanray Milling Co. Pty. Ltd., 131 Queen-street, Melbourne
Lanray Wheat Polishings No. 2	9·0	4·5	14·5	,, ,, ,, ,, ,, ,,
Tyner's Wheat Meal	9·5	1·5	2·5	W. Tyner Pty. Ltd., 623 Collins-street, Melbourne
Cohana Wheat Meal	9·5	2·0	2·5	Cohana Stockfood Co., Shed No. 9, Williamstown Pier
Cohana Crushed Wheat	9·5	2·0	2·5	,, ,, ,, ,, ,, ,,
V.W.C. Crushed Wheat	9·5	1·5	3·0	Victorian Wheatgrowers Corp. Ltd., 17 Queen-street, Melbourne
V.W.C. Ground Wheat	9·5	1·5	3·0	,, ,, ,, ,, ,, ,,
P. and F. Wheatmeal	10·0	2·0	3·0	Poultrymen and Farmers Trading Co., 276 Queensberry-street, North Melbourne
Echuca Crushed Wheat	11·0	1·5	2·5	Echuca Flour Mills Pty. Ltd., Echuca
Crushed Wheat	9·5	1·5	2·5	North-Eastern Co-op. Soc. Ltd., Wangaratta
Crushed Wheat	9·5	1·5	3·5	British United Dairies Pty. Ltd., 33–35 King-street, Melbourne
Malcolm's Crushed Wheat	9·5	2·0	2·5	James Malcolm and Co. Pty. Ltd., St. Arnaud
Evans' Crushed Wheat	9·5	1·5	3·0	Evans Grain and Produce Co., Benalla
Bransum Wheat Flakes	10·0	2·0	3·5	R. Mackay and Sons, Spring Vale South
Cromarty No. 1 Rolled Wheat	8·5	1·5	2·5	,, ,, ,, ,,
Polplus Wheat Semolina	9·0	2·0	2·0	,, ,, ,, ,,
Kerang Gristed Wheat	9·5	2·0	2·5	Kerang Flour Milling Co. Pty. Ltd., Kerang
Bush's Crushed Wheat	9·5	1·5	3·0	Albert Bush, Williamson-road, Bendigo
Bush's Ground Wheat	9·5	1·5	3·0	,, ,, ,, ,, ,,

Distinguishing Brand Name.	Guaranteed Composition. Crude Protein (N x 6·25). Minimum.	Crude Fat. Minimum.	Crude Fibre. Maximum.	Where Obtainable.
BRAN AND POLLARD.	%	%	%	
The following firms have registered distinguishing brand names for Bran† and Pollard‡ :—				
T. Brunton and Co. Pty. Ltd.	..	..	..	531 Collins-street, Melbourne
Burnley Flour Mills Pty. Ltd.	..	..	..	376 Swan-street, Burnley
Darling (John) and Son	..	..	..	44 King-street, Melbourne
Echuca Flour Mills Pty. Ltd.	..	..	..	Echuca
Garden City Flour Mill	..	..	..	Trench-street, Ballarat
Grant and Wilson	..	..	..	McNally-street, Yarrawonga
Kimpton (W. S.) and Sons	..	..	..	395 Collins-street, Melbourne
Maryborough Flour Mills Pty. Ltd.	..	..	..	Maryborough
McLennan and Co. Pty. Ltd.	..	..	..	Mooroopna
Minifie (James) and Co. Pty. Ltd.	..	..	..	422 Collins-street, Melbourne
Noske Flour Mills Pty. Ltd.	..	..	..	108 Queen-street, Melbourne
Schutt and Barrie Flour Mills Pty. Ltd.	..	..	..	Sunshine-road, West Footscray
Silver Lake Flour Mill Pty. Ltd.	..	..	..	Sale
Smith (W. and P.)	..	..	..	35 Cusack-street, Wangaratta
Stratton and Co. Pty. Ltd.	..	..	..	68 Lulle-street, Abbotsford
Swan Milling Co.	..	..	..	Swan Hill and 1 Bent-street, Northcote
Sunraysia Flour Mills Pty. Ltd.	..	..	..	Mildura
Thomas (W. C.) and Sons Pty. Ltd.	..	..	..	55 William-street, Melbourne
Tomlins, Simmie and Co.	..	..	..	87 Charleston-road, Bendigo
Wangaratta Flour Mills Co. Pty. Ltd.	..	..	..	Wangaratta
Willis Bros.	..	..	..	Kyneton
Wimmera Flour Mill Co. Pty. Ltd.	..	..	..	Stawell
Water Wheel Flour Mills Pty. Ltd.	..	..	..	83 William-street, Melbourne
Wise Bros. Pty. Ltd.	..	..	..	530 Collins-street, Melbourne
Howard Jackett and Co. Pty. Ltd.	..	..	..	534 Bridge-road, Richmond
Hudson and Co. Pty. Ltd. (Bran only)	..	..	..	Harcourt-parade, Richmond
Hutchinson's Finley Flour Milling and Agency Co. Pty. Ltd.	..	..	..	Glenroy
Burrows Hume Flour Mills	..	..	..	Albury
Corowa Milling Co. Ltd.	..	..	..	Corowa
Elmore Flour Mills Pty. Ltd.	..	..	..	Elmore
James Malcolm and Co. Pty. Ltd.	..	..	..	St. Arnaud
Kerang Flour Milling Co. Pty. Ltd.	..	..	..	Kerang
† The 1949 Chemical Standard for Bran is	14·0	2·5	10·0	
‡ The 1949 Chemical Standard for Pollard is	14·0	3·0	6·25	
OAT PRODUCTS.				
Parsons' No. 1 Oat Branning	10·0	6·75	16·0	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Parsons' No. 2 Oat Branning	7·5	5·75	15·25	" " " " " "
Harper's Star Oat Branning	8·0	6·5	15·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Ward's Oat Branning	6·0	4·0	25·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Connell's Oat Branning	8·0	5·5	24·0	John Connell and Co. Ltd., 578 Bourke-street, Melbourne
McKenzie's Oat Branning	7·0	4·0	20·0	J. F. McKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
Parsons' No. 2 Oat Screenings	8·5	5·5	13·25	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Parsons' No. 3 Oat Screenings	7·0	5·0	21·25	" " " " " "
Connell's Oat Pollard	11·8	9·0	2·0	John Connell and Co. Ltd., 578 Bourke-street, Melbourne
Lyall's Oat Pollard	10·0	7·0	7·0	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne
McKenzie's Oat Pollard	10·0	8·0	5·0	J. F. McKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
T.B. and S. Oat Screenings	9·0	5·0	15·0	T. Borthwick and Sons (A/asia) Ltd., 84 William-street, Melbourne
T.B. and S. Oat Pollard	13·0	7·0	2·0	" " " " " "
T.B. and S. Oat Branning	10·0	5·0	15·0	" " " " " "
Lanray No. 1 Oat Branning	10·0	6·75	16·0	Lanray Milling Co. Pty. Ltd., 131 Queen-street, Melbourne
Lanray No. 2 Oat Branning	7·5	3·0	25·0	" " " " " "
Cohana Crushed Oats	10·0	4·0	7·0	Cohana Stockfood Co., Shed No. 9, Williamstown Pier
Cohana Ground Oats	10·0	4·0	7·0	" " " " " "
P. and F. Oaten Meal	10·0	6·0	3·5	Poultrymen and Farmers Trading Co., 276 Queensberry-street, North Melbourne
A.B.C. Oat Branning	6·0	4·0	25·0	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
A.B.C. Oat Pollard No. 1	10·0	8·0	5·0	" " " " " "

Distinguishing Brand Name.	Guaranteed Composition.			Where Obtainable.
	Crude Protein (N x 6·25). Minimum.	Crude Fat. Minimum.	Crude Fibre. Maximum.	
OAT PRODUCTS—*continued.*	%	%	%	
Garden City Crushed Oats	10·7	6·5	11·5	Garden City Flour Mill, Ballarat
Crushed Oats	8·0	3·0	3·5	North-Eastern Co-op. Soc. Ltd., Wangaratta
Crushed Oats	10·0	4·5	11·5	British United Dairies Pty. Ltd., 33–35 King-street, Melbourne
Echuca Crushed Oats	9·0	4·5	18·0	Echuca Flour Mills Pty. Ltd., Echuca
Malcolm's Crushed Oats	7·5	4·0	16·0	James Malcolm and Co. Pty. Ltd., St. Arnaud
RYE PRODUCT.				
P. and F. Rye Meal	9·5	3·5	4·0	Poultrymen and Farmers Trading Co., 276 Queensberry-street, North Melbourne
BARLEY PRODUCTS.				
Harper's Star Barley Meal	12·5	5·5	7·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Ward's Barley Meal	10·0	4·0	10·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Lyall's Barley Meal	10·0	2·0	5·0	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne
Connell's Barley Meal	10·4	4·5	7·0	John Connell and Co. Ltd., 578 Bourke-street, Melbourne
A.B.C. Barley Meal	10·0	4·0	10·0	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
Lanray Barley Meal	9·0	2·5	20·0	Lanray Milling Co. Pty. Ltd., 131 Queen-street, Melbourne
Pratt's Ground Barley	7·0	1·0	7·0	David Pratt and Sons, Mair-street, Ballarat
Connell's Barley Branning	16·4	6·0	20·0	John Connell and Co. Ltd., 578 Bourke-street, Melbourne
Harper's Star Barley Branning	10·0	5·0	15·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Parsons' Barley and Oat Pollard	11·0	5·5	10·0	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Lyall's Barley and Oat Meal	10·0	4·0	7·0	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne
McKenzie's Barley Pollard	12·0	3·0	20·0	J. F. McKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
Parsons' Barley Meal	14·0	6·0	9·0	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Cohana Barley Meal	10·0	4·0	7·0	Cohana Stockfood Co., Shed No. 9, Williamstown Pier
P. and F. Barley Meal	10·0	3·0	5·0	Poultrymen and Farmers Trading Co., 276 Queensberry-street, North Melbourne
Kelric No. 1 (Dried Distillers' Grains)	27·0	9·0	11·0	K.B. Stock Food Co. Pty. Ltd., 48 Wellington-street, Collingwood
Kelric No. 2 (Dried Brewers' Grains)	18·0	4·0	17·0	" " " "
A.B.C. Barley and Oat Pollard	11·0	5·5	10·0	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
RICE PRODUCTS.				
Harper's Star White Rice Meal	9·0	12·5	5·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Harper's Star Brown Rice Meal	10·0	16·0	7·5	" " " "
Parsons' Rice Meal	10·0	19·0	9·5	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Harper's Rice Bran	6·0	7·0	20·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
McKenzie's Rice Pollard	10·0	15·0	8·0	J. F. McKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
A.B.C. Rice Bran	5·0	6·0	40·0	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
A.B.C. Rice Pollard	10·0	15·0	8·0	" " " " " "
MAIZE PRODUCTS.				
Polly Gluten Feed	20·0	3·0	9·0	Maize Products Pty. Ltd., corner Parker and Maribyrnong streets, Footscray
Maize Oil Meal	16·0	12·0	10·0	" " " "
Ward's Maize Meal	7·0	3·0	4·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Lyall's Maize Meal	9·0	3·0	2·0	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne
Clark's Maize Meal	9·0	3·0	3·0	Clark, King and Co. Pty. Ltd., 237 Queen-street, Melbourne
Pratt's Ground Maize	7·0	2·0	3·5	David Pratt and Sons, Mair-street, Ballarat
Parsons' Wet Maize Bran	3·0	1·0	2·0	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne

Distinguishing Brand Name.	Guaranteed Composition.			Where Obtainable.
	Crude Protein (N x 6·25). Minimum.	Crude Fat. Minimum.	Crude Fibre. Maximum.	
MAIZE PRODUCTS—*continued.*	%	%	%	
A.B.C. Maize Meal	7·0	3·0	4·0	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
Morgrain Maize Meal	9·0	3·0	3·0	Norris and Wilkinson, Tinning-street, Brunswick
V.W.C. Maize Meal	9·0	3·0	2·0	Victorian Wheatgrowers Corp. Ltd., 17 Queen-street, Melbourne
Marvel Maize Meal	8·0	3·0	4·0	J. McBeth, 207 Neerim-road, Carnegie
P. and F. Maize Meal	9·0	4·0	3·0	Poultrymen and Farmers Trading Co., 276 Queensberry-street, North Melbourne
Creamo Maize Meal	9·0	3·0	2·0	R. Mackay and Sons, Spring Vale South
PEA PRODUCTS.				
Parsons' Pea Meal	16·0	1·5	18·75	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Ward's Pea Meal	14·0	1·0	18·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Harper's Split Pea Screenings	9·0	0·75	22·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Parsons' Pea Screenings	16·25	1·0	6·0	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
McKenzie's Pea Pollard	20·0	1·0	10·0	J. F. McKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
A.B.C. Pea Meal	20·0	1·0	10·0	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
P. and F. Pea Meal	20·0	1·0	6·0	Poultrymen and Farmers Trading Co., 276 Queensberry-street, North Melbourne
HULLS.				
Parsons' Barley Hulls	2·5	0·6	39·75	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Connell's Barley Dust	5·0	0·25	18·0	John Connell and Co. Ltd., 578 Bourke-street, Melbourne
Ward's Barley Hulls	2·0	0·8	32·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
McKenzie's Pea Hulls	6·0	0·5	40·0	J. F. McKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
Parsons' Pea Hulls	3·5	0·4	46·25	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Ward's Pea Hulls	5·0	0·25	40·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Parsons' Oat Hulls (A)	1·25	0·4	40·75	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Parsons' Oat Hulls (B)	4·25	3·0	30·0	" " " " " "
Parsons' Oat Hulls (C)	5·0	1·25	34·0	" " " " " "
Ward's Oat Hulls	1·5	0·7	35·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Connell's Oat Hulls	0·5	0·5	35·0	John Connell and Co. Ltd., 578 Bourke-street, Melbourne
Harper's Oat Hulls	1·0	0·75	35·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
McKenzie's Oat Hulls	1·5	1·0	35·0	J. F. McKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
T.B. and S. Oat Hulls	1·5	0·4	40·0	T. Borthwick and Sons (A/asia) Ltd., 84 William-street, Melbourne
Lanray Oat Hulls	1·25	0·4	40·75	Lanray Milling Co. Pty. Ltd., 131 Queen-street, Melbourne
Lanray Barley Hulls	2·5	0·6	40·0	" " " " " "
A.B.C. Oat Hulls	1·5	0·7	35·0	E. T. Moulden and Son Pty. Ltd., 294 Victoria-street, North Melbourne
MISCELLANEOUS.				
Lucerne Meal	13·0	3·0	25·0	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne
Lupol	10·0	1·0	35·0	E. C. Robertson Pty. Ltd., 527 Collins-street, Melbourne
Biscuit Sweepings	2·0	2·0	2·0	Swallow and Ariell Ltd., 60 Stokes-street, Port Melbourne
Bakehouse Sweepings	2·0	2·0	2·0	" " " " " "
V.W.C. Milo Meal	7·9	2·6	1·8	Victorian Wheatgrowers Corp. Ltd., 17 Queen-street, Melbourne
F.P.C. Flax Meal	16·0	14·0	15·0	Flax Production Committee, 440 Little Collins-street, Melbourne
F.P.C. Crushed Flax Chaff	11·0	6·0	28·0	" " " " " "

VITAMIN OILS.

Distinguishing Brand Name.	Guaranteed Composition. (In International Units per gram.)		Where Obtainable.
	Vitamin A. (Minimum.)	Vitamin D. (Minimum.)	
Sol-Vit-Ax Cod Liver Oil	500	50	G. P. Embleton and Co. Pty. Ltd., 208 Little Lonsdale-street, Melbourne
Unicod Double Vitaminised Blended Feeding Oil	2,000	200	Altantic Union Oil Co. Ltd., 396 Collins-street, Melbourne
Vetemul Blue Label Vitaminized Emulsion	5,000	Nil	Nicholas Pty. Ltd., 37 Swanston-street, Melbourne
Vetemul Green Label Vitaminized Emulsion	5,000	500	" " " " " "
Vetemul Brown Label Vitaminized Emulsion	1,000	100	" " " " " "
Apsolene 2,500	2,500	Nil	Australian Packers' Corp. Pty. Ltd., 414 Collins-street, Melbourne
Apsolene	5,000	Nil	" " " " " "
Apsolene 2,500 A.D.	2,500	250	" " " " " "
Apsolene A.D.	5,000	500	" " " " " "
Ocean Gold	2,500	Nil	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Deaol	1,000	400	Australian Packers' Corp. Pty. Ltd., 414 Collins-street, Melbourne
Seaol	1,000	100	" " "
Ava "A" Vitaminised Oil Emulsion	2,500	Nil	A. A. Emulsion Co. Pty. Ltd., 55 Hobson's-road, South Kensington
Ava "A and D_3" Vitaminised Oil Emulsion	2,500	250	" " "
Isco Veterinary Cod Liver Oil	800	100	W. J. Cartledge and Co., 260 Brunswick-street, Fitzroy
Tallyvite "A"	5,000	Nil	Tally Ho Products, 29 Courtney-street, North Melbourne
Tallyvite "A and D_3"	5,000	500	" " " " " "

STOCK LICKS.

Distinguishing Brand Name.	Guaranteed Composition.							Where Obtainable.
	Salt.	Phosphoric Acid.	Lime.	Magnesia.	Iron.	Sulphur.	Iodine.	
STOCK LICKS.	% (Max.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	
Common Salt.								
Hart's Roklik	100·0	..	..	..	..	..	..	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Lepp Salt Lick	100·0	..	..	..	..	..	..	R. Lohn and Co. Pty. Ltd., 44–54 Spencer-street, Melbourne
Ram Salt Lick	100·0	..	..	..	..	..	..	Cheetham Salt Pty. Ltd., 71 Little Malop-street, Geelong
Ramlic	97·0	..	..	..	..	3·0	..	" " " "
Hart's Iodised Block Lick	99·0	..	..	..	0·5	..	Trace	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Hart's Sulphurised Block Lick	98·0	..	..	..	..	2·0	..	" " " "
Bone Meal, &c.								
Apex Sterilized Bone Meal	..	24·0	28·0	..	..	..	..	North-Eastern Bone Products, Wangaratta
Cockbill's Bone Meal	..	21·76	27·6	..	..	..	..	J. Cockbill, Footscray-road, Footscray
Tricalos Sterilized Bone Flour	..	30·0	40·0	..	..	..	..	Glues and By-Products Pty. Ltd., 86 King-street, Melbourne
Cockbill's Bone Grit	..	20·0	25·27	..	..	..	..	J. Cockbill, Footscray-road, Footscray
Pannifex Bone Meal	..	22·0	26·0	..	..	..	..	H. C. Pannifex and Co. Pty. Ltd., 53–57 Munster-terrace, North Melbourne
D.B.G. Bone Meal	..	28·0	36·0	..	..	..	..	W. Angliss and Co. (Aust.) Pty. Ltd., Lynch-street, Footscray
Sickle in Diamond Dicalcic Phosphate	..	37·5	29·6	..	..	..	..	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
MIXED STOCK LICKS.								
Non Salt.								
Cobaltised Concentrated Vic-Lic †	..	24·0	29·9	..	5·8	..	Trace	Wilcox, Mofflin Ltd., 34 King-street, Melbourne
Vic-Lic D Concentrated Sheep Lick	..	24·0	29·9	..	2·9	..	Trace	" " " "
Vic-Lic G Concentrated Sheep Lick	..	24·0	29·9	..	5·8	..	Trace	" " " "

† Contains cobalt and copper.

Distinguishing Brand Name.	Guaranteed Composition.							Where Obtainable.
	Salt.	Phosphoric Acid.	Lime.	Magnesia.	Iron.	Sulphur.	Iodine.	
MIXED STOCK LICKS—*continued.*	% (Max.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	
Non-Salt—continued.								
Vita-Lick Concentrated D ..	..	23·5	30·0	..	1·3	2·0	Trace	Goldsbrough, Mort, and Co. Ltd., 526 Bourke-street, Melbourne
Vita-Lick Concentrated G ..	..	23·5	31·0	..	3·5	4·0	Trace	" " " "
Vita-Lick Cattle Concentrated G	..	25·0	32·5	..	4·7	1·15	Trace	" " " "
Vita-Lick Cobaltised Concentrated G*	..	23·5	31·0	..	3·5	4·0	Trace	" " " "
Vita-Lick Cattle Concentrated D	..	21·2	29·0	..	3·4	0·4	Trace	" " " "
Vita-Lick Cobaltised Concentrated D*	..	23·5	30·0	..	1·3	2·0	Trace	" " " "
Vetsolick Mineral Concentrate	..	11·0	14·0	0·7	1·5	16·6	Trace	A. H. McDonald, 627 Bridge-road, Richmond
Eureka Poultry Minerals ..	..	2·1	4·4	0·1	0·1	0·25	Trace	Eureka Mineral Poultry Foods, 14 Chesterville-road, Cheltenham
Rawleigh's Poultry Powder†	..	8·9	33·0	..	0·4	4·0	Trace	The W. T. Rawleigh Co. Ltd., 60 Dawson-street, Brunswick
Low Salt.								
Allkon Concentrate ..	8·0	12·0	30·0	..	1·0	..	Trace	Allkon Pty. Ltd., 36 Clarendon-street, South Melbourne
Vic-Lic Concentrated Cattle Lick	5·5	23·0	29·0	..	2·9	..	Trace	Wilcox, Moffiin Ltd., 34 King-street, Melbourne
Immunolic Concentrate ..	8·0	12·0	30·0	..	1·0	..	Trace	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Medium Salt.								
Rudduck's Improved Mineral Lick	22·2	11·3	20·3	0·6	0·6	2·4	Trace	Rudduck and Co. Pty. Ltd., 556 Lonsdale-street, Melbourne
Rawleigh's Mineralized Supplement	15·0	7·1	25·2	..	1·0	3·6	Trace	The W. T. Rawleigh Co. Ltd., 60 Dawson-street, Brunswick
High Salt.								
Vetamac Medicated ..	53·0	5·7	7·5	0·1	0·7	4·0	Trace	A. H. McDonald, 627 Bridge-road, Richmond
Hart's Block Lick	91·0	1·0	3·0	..	..	..	..	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Salvitis No. 1	90·0	1·8	2·5	0·2	0·8	0·4	Trace	Cheetham Salt Pty. Ltd., 71 Little Malop-street, Geelong
Salvitis No. 2	70·0	7·1	8·8	0·2	0·8	4·0	Trace	" " " "
Hart's Cobalt Block Lick† ..	91·0	1·0	3·0	..	..	..	..	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Lime Licks.								
Allkon Organic Lime Compound	..	..	7·0	..	..	..	..	Allkon Pty. Ltd., 36 Clarendon-street, South Melbourne
Hart's Immunol Organic Lime Compound	..	..	7·0	..	..	..	..	Hart and Co. Pty. Ltd., 38 Clarendon-street, South Melbourne
Hart's Immunol Special Organic Lime Compound	..	..	7·0	..	..	..	..	" " " "
Allkon Special Organic Lime Compound	..	..	7·0	..	..	..	..	Allkon Pty. Ltd., 36 Clarendon-street, South Melbourne
Fargher's Calcium Lick ..	..	4·5	65·0	..	..	..	..	W. J. Fargher, 610 Ligar-street, Ballarat

* Contains trace of cobalt.

† Contains cobalt and copper.

W. R. JEWELL, M.Sc.
Chemist for Agriculture.

Melbourne, 7th April, 1949.

Report of the Judge, G. T. Thompson, A.M.I.E. (Aust.), Executive Officer, Soil Conservation Board, on the Fifth Annual Competition.

THE Goulburn Catchment Soil Conservation Competition is held annually to determine the best effort at soil conservation made each year by a farmer within the catchment of the Goulburn River. For the purposes of the competition, the catchment includes the Shires of Benalla, Violet Town, Euroa, Goulburn, Kilmore, Pyalong, Seymour, Broadford, Yea, Alexandra, Mansfield and part of the Shires of Shepparton and Healesville.

This year, the Shires of Kilmore and Pyalong were included for the first time, the competition area now very closely conforming with the Upper Goulburn Region as defined by the Regional Planning Authority. The councils of twelve shires in this year's competition, offered prizes for the best entry within their respective shires. This is a most pleasing indication of the interest taken by the municipal authorities concerned. In six of these shires, entries were insufficient to justify the shire award being made. By further local encouragement it is hoped that in future years there will be sufficient entries in each shire to justify the presentation of all awards offered.

Thirty-seven entries were received, involving a total area of 43,228 acres. The general standard is definitely improving and all land owners had interesting and special features to show. Sound land management and pasture development are common on most of the properties entered. On many farms extensive areas have been contour-furrowed and other mechanical measures of erosion control have been put into practice.

BASIS OF JUDGING

In judging a competition of this nature the degree of erosion hazard is the first thing to be considered. Assessment of the success of the measures adopted by the land holder, either to prevent erosion from developing, or to arrest its further development, must be made in the light of the existing erosion hazard. The build-up in soil fertility and carrying capacity are also matters to be considered, and soil type, topography, climate and period of occupancy by the present owner are taken into account. If a major effort at control has been made on part of a property, and treatment of the remainder planned, a property may be

ranked high, although it may include some areas of uncorrected erosion. Shortage of labour and materials, particularly for fencing, are still preventing most land holders from extending their soil conservation programmes as they would wish.

A striking comparison is provided in the above picture of a paddock on which rabbits are uncontrolled and one from which they have been eliminated. A netting fence separates the two paddocks.

PASTURE MANAGEMENT

All of the entrants carried out grazing as their main farming pursuit, very largely with sheep, but cattle, although fewer in number, form a very important part of the region's grazing industry. All competitors use superphosphate for top-dressing their pastures, and now that the fertilizer is more readily available, its more extensive use on grazing land is most noticeable. One result is an improvement in ground cover and carrying capacity. On hill country on many of the properties entered, a satisfactory development of subterranean clover, together with the native perennials, was apparent. The continuous maintenance of such a pasture reflects sound management and ensures a steady build-up in fertility and resistance to erosion.

Striking evidence of the build-up in ground cover and improved carrying capacity resulting from effective rabbit control was afforded by most entrants. It is becoming increasingly apparent that the virtual elimination of the rabbit is one of the greatest single contributions that can be made to soil conservation.

SOIL TYPES

Broadly speaking, there are two main soil types in the area—those derived from sedimentary rocks and those from granites and similar rock formations. Both types present an erosion hazard, but granitic soils appear to respond more readily to lenient treatment and good seasons. The type of sedimentary soils usually referred to locally as "ironstone" are shallow, and when bared of vegetation, develop a "skinned" surface which readily sheds water. Large areas are thus sheet-eroded and re-establishment of vegetation is difficult.

"Tunnelling," one of the worst forms of erosion, is common. Results obtained from the treatment of tunnelled soils are slow and major works are often required to bring them back into worth-while production. Early results from top-dressing on this type of country are sometimes disappointing. On the other hand, granitic soils do not easily suffer from sheet erosion; they respond well to top-dressing and to the effects of a good season.

TIME OF JUDGING

Soil conservation competitions are judged in the autumn, so that the amount of cover left on the soil at the end of the season can be seen. The provision of a sufficient body of old feed in a paddock to protect both soil and new growth is essential. Also, there should be sufficient conserved fodder to carry the stock through an adverse season.

The early break in the season this year resulted in prolific new growth during the period of judging. The quantity of old feed still in the paddocks was, however, readily seen. Most contestants had made ample provision for a normal to late break, but in a few cases the amount of old feed left was light and indicated some over-stocking. On the other hand there were two or three instances where more stock could have been safely carried.

CONTOUR WORKS

The recently-introduced practices of ploughing level or contour furrows on grassland, and the diversion of water from gully-heads and its disposal by spreading over grassland are becoming general. By these means rain is retained and utilized on the hillsides to increase grass cover and protect the soil. Many of the entrants have ploughed contour furrows on portions of their properties. On one property the area furrowed was as much as 500 acres. It is important to remember, however, that contour furrowing is a mechanical measure designed to

ensure that the soil remains where it belongs. Furrowing alone may be sufficient to achieve soil stability, but to obtain maximum benefit it is usually desirable for the practice to be accompanied by top-dressing, together with shallow working of the land between the furrows and the spreading of a suitable mixture of pasture seed. Some most interesting experimental work on pasture development between furrows was put in hand during the year by two of the entrants. This is referred to in more detail later in this article.

the hill by eye are almost certain to be off contour and will lead the water to low spots where it will break through. The Soil Conservation Board provides a service of free survey limited only by the size of its staff. If contour works of any kind are contemplated land holders should not hesitate to seek this assistance.

Diversion Works

More disastrous still is the fairly common attempt to construct diversion works on lines judged by the eye. One entrant in this year's competition had built diversion works laid out by eye. Some of these ran the wrong way, others were too steep and some scours had started. These errors have been difficult to correct and would not have occurred if the lines had been correctly surveyed prior to construction. The land-owner now freely admits his mistake.

Gully control on R. A. E. Harding's property, Pyalong.

Lower picture—Catchment has been contour-furrowed, head of gully battered and grassed.

Right—The same gully looking downstream. The furrow in the foreground has a slight grade to lead water from the gully head.

Contour Furrowing—A Warning

A warning to those who contemplate contour furrowing on their properties is necessary. The contour furrow is intended to block the flow of all the water that runs off between it and the furrow above. Its capacity and spacing must, therefore, be such that it is able to hold all the rain that falls and allow for its absorption, so that surface run-off from a furrowed area does not occur.

The furrow must be on the true contour or as near to it as possible. The lay-out of a contour-line can be obtained only by the use of some form of level. By far the quickest and most efficient instrument is the "dumpy" level. Furrows ploughed around

Attention to Newly-Contoured Land

After an area has been contour furrowed some early attention to the furrows is usually necessary to ensure their efficient functioning. This may mean some hand-work building up weak spots or ploughing of some short, extra furrows where, because of an irregular surface, they are too far apart. The requirements in this direction can best be seen during rain, consequently an inspection in wet weather is desirable.

Satisfactory spacing between furrows on the slopes will usually result in too wide a spacing where the furrows cross the depressions. Extra furrows are required in these locations and may, with advantage, be given

a slight fall towards the spurs, thus resulting in a flow towards the drier spurs where more water may be absorbed.

LIST OF COMPETITORS

Name of Competitor.	Address.	Shire.
E. G. Foletta and Son	Buxton	Alexandra
C. S. Hartridge ..	"Warramong", Benalla	Benalla
T. C. Wise ..	"Shambara", Winton	Benalla
C. W. Webster ..	Benalla	Benalla
R. A. E. Harding	"Kimberley", Broadford	Broadford
L. E. Dotter ..	"Happy Valley", Broadford	Broadford
C. G. Halpin ..	"Glenburnie Park", Broadford	Broadford
J. H. Collins ..	Ruffy	Euroa
Shovelton and Son	Creighton's Creek	Euroa
C. Kelly ..	Creighton's Creek	Euroa
R. F. Kelsall ..	Creighton's Creek	Euroa
R. H. Threlfall ..	Creighton's Creek	Euroa
L. J. Sargood ..	"Hillside", Gooram	Euroa
McIntosh and Son	"The Willows", Castle Creek	Euroa
C. M. H. Chomley	"Killeen", Longwood	Euroa
K. Stribling ..	Euroa	Euroa
N. J. McKendrick	Balmattum East ..	Euroa
S. J. Bower ..	Euroa	Euroa
R. Smith ..	Strathbogie ..	Euroa
A. G. Smith ..	Strathbogie ..	Euroa
H. T. Yencken ..	Mansfield ..	Mansfield
E. O. Bidstrup ..	"Annadale", Broadford	Pyalong
J. H. Waugh ..	"Colindale", Seymour	Pyalong
R. A. E. Harding	Sugarloaf Creek ..	Pyalong
S. Shelton ..	"Currawong", Avenel	Seymour
A. J. Lane ..	"Broxbourne", Monea	Seymour
R. R. Webster ..	"Winterfold", Avenel	Seymour
E. M. Head and Partners	Seymour ..	Seymour
G. H. Dore ..	"Rivary", Avenel	Seymour
E. C. L. Head ..	"Mundara", Seymour	Seymour
Mrs. I. D. Green	"Honeysuckle", Violet Town	Violet Town
R. J. Wilson ..	Violet Town ..	Violet Town
L. C. Hollis ..	Broadford ..	Yea
P. J. George ..	Strath Creek ..	Yea
T. C. Byrne ..	Spring Valley ..	Yea
W. E. D. Robinson	Flowerdale ..	Yea
H. C. Gordon ..	Murrindindi ..	Yea

Sheep pads and old tracks crossing a furrowed area may cause the furrows to break, and special care is required here. This attention to detail may be somewhat tedious but may mean the difference between success and failure. When planning ahead, time should be allowed for carrying out this maintenance work; consequently too large an area should not be furrowed in one year.

THE AWARDS

Mr. C. W. Webster, the winner of this year's competition, holds the Hanslow Cup for the year and receives a trophy from the Soil Conservation Board. Mr. Webster's property of 1,100 acres to the east of the Hume Highway, near Winton, has been used almost wholly for the grazing of sheep. Part of the property is flat, but it rises to low hill features on which sheet erosion had developed.

During the ownership of Mr. Webster's father a deeply-incised gully worked up into the property. A major effort at control by the construction of various structures in timber, brick and concrete was completely successful in arresting the further extension of this gully. The area around the structures was also fenced in and planted to trees and perennial grasses, including Kikuyu and couch.

A progressive policy of pasture development has been followed in the last few years. Irregular crab-holey country on the heavy flats was levelled, cultivated and sown to oats prior to sowing Wimmera rye grass and subterranean clover. These have formed excellent pastures and the soil texture has improved considerably. Paddocks on rising country, where many bare areas were apparent, are being similarly brought under improved pasture. The clearing of stumps precedes the first cultivation, and all available straw and brush is worked into the surface of the soil to provide a mulch during the period of pasture establishment.

About 50 acres of hill country has been contour-furrowed and top-dressed. Special care was taken to break up the sod and hold it as an unbroken ridge close to the furrows, and extra furrows with a slight grade were ploughed in a depression to lead water to the side slopes. This attention to detail has been well repaid, as the furrows and sods are now well grassed and the area has developed into a fine mixed pasture of wallaby grass and sub-clover.

Full advantage was taken of the site for the main dam near the house to design an excellent grassed spillway. Small breaks in

the natural drainage area above the treated gully-head have been protected with straw, wire-netting and brush. The one criticism that can be offered on this property is that rabbit control in the main gully has not yet been fully effective. The proposal is to fence in this area when netting becomes available.

BENALLA SHIRE

Mr. T. C. Wise was awarded the Benalla Shire Council prize. Mr. Wise has recently taken over this property of 550 acres which is also in the Winton district. He has contour-furrowed about 90 acres of it, some parts located on bare ironstone hills. These have effectively arrested sheet erosion and a steady improvement is noticeable. Diversion banks have been constructed to arrest gully-head erosion and the sides of the gully itself have been graded in. Pasture development is proceeding satisfactorily and rabbit control has been effected. This property has plenty of promise and the programme of development is progressing well.

Mr. C. S. Hartridge, whose property of 688 acres is in the Parish of Tatong, has recently constructed an extensive system of diversion banks to prevent gully erosion. These should prove very effective. He is clearing and preparing new hilly country for pasture development and intends to work on the contour.

Severe erosion on a road causes siltation on Mrs. I. D. Green's property near Violet Town.

BROADFORD SHIRE

Mr. L. E. Dotter, whose holding is on the King Parrot Creek, won the Broadford Shire award. The property of 377 acres extends into two shires, but was accepted this year as a Broadford entry. It consists of creek flats and hill country which is very steep in parts. The aim has been to develop into high production the cleared portions and not to clear any more hill land until it can be effectively controlled. Erosion in a gully has been stopped with concrete structures and tree-planting, and the bed is now grassing over. A tendency to rilling along steep tracks has been stopped by the placement of small concrete slabs. Bank erosion along the creek has been prevented by willow planting.

Mr. Dotter's farm was the most beautiful and neatest property inspected in this year's competition. Full use has been made of trees and everything around the farm is kept in its right place. A high-pressure water supply is being installed for domestic fire-fighting and spray irrigation purposes. Concrete troughs are under construction for stock watering from springs.

A diversion bank (right) for leading water away from a deep gully on Mr. R. J. Wilson's property near Violet Town. A spillway on grassland is provided at the far end of the bank.

A fine stand of red gum on the property of Mr. C. M. H. Chomley, "Killeen," Longwood.

Mr. C. G. Halpin is ploughing an area of 180 acres of rising country through which severe gully erosion has occurred. His intention is to sow down pasture with a cover crop of oats. Several areas of sheet eroded country in another paddock are to be contour furrowed.

Mr. R. A. E. Harding entered two properties. The home property near Broadford consists of 230 acres, is well sub-divided and netted. Pasture improvement and fodder conservation are notable, and a small area of contour furrows ploughed on top of a bare basalt hill has resulted in restoration of this land to a marked degree.

EUROA SHIRE

Euroa Shire provided thirteen entries, by far the greatest number in any Shire in this year's competition. The standard of entry in the Euroa Shire was high, and several land owners have done a great deal towards conserving soil on their properties. After weighing the various points in favour of several properties, the decision was given to Mr. Roy Smith, Strathbogie, as submitting the best entry in the shire.

This property of 416 acres is on granitic undulating country. It has been occupied by Mr. Smith since 1938 and during that time its carrying capacity has been built up by careful stocking and pasture development. This competitor has also succeeded in bringing under control both sheet and gully eroded areas. During the first three years Mr. Smith reduced his stocking rates to a minimum to build up cover over the soil, and this has paid handsome dividends. Also, by care in grazing management the percentage of native grasses in a clover-dominant pasture has been increased. Mechanical works designed to control erosion include small diversion banks and the filling-in and grassing-down of gullies. Mr. Smith has a sound plan for subdivisional fencing and tree planting for shelter.

A striking feature on Mr. C. M. Chomley's property, "Killeen," Longwood, is the fine stand of mature red gum retained for shade and commercial purposes. The possible return from a stand of useful timber is seldom realised. It is certainly a long-term crop, but may ultimately return more per acre than most other crops. In the meantime the growing trees provide shade and shelter for stock, and beautify the property.

Mr. K. Stribling this year entered his property in the Parish of Garratanbunel. It is mainly granitic hill country with an average annual rainfall of 32 inches. The whole property is well covered with a balanced pasture of Wallaby grass and subterranean clover which has been maintained by effective rabbit

Sheet erosion and siltation on a ploughed paddock near Euroa. This could have been prevented by contour working.

control and a good balance of sheep and cattle. Good use has been made of small pieces of netting to block entry by rabbits into rocky outcrops.

Mr. S. J. Bower, on his small and efficiently-run property near Seven Creeks, is continuing his programme of pasture development. Unfortunately some loss of soil had occurred from a paddock which was under fallow preparatory to sowing down. It is always wise to follow the contour when breaking up country susceptible to erosion. Small guide banks located at intervals on the true contour can be formed with the plough and these act as base lines for contour working. Officers of the Soil Conservation Board are available to give levels for this contour working.

Well-grassed granitic hills on the property of Messrs McIntosh and Son, Castle Creek. This cover has been achieved by eliminating the rabbit and by controlled grazing.

PYALONG SHIRE

The standard of the three entries in the Pyalong Shire was high, each competitor having carried out a large amount of mechanical work on difficult country. The shire award goes to Mr. J. H. Waugh, "Colindale."

This competitor's property of 5,000 acres is undulating to hilly ironstone country. Sheet erosion, gullying and tunnel erosion have developed to a marked degree. Some country is also denuded by salt. Mr. Waugh is now making a major effort to arrest the further development of this erosion and to bring the land back into full production. He has contour-furrowed an area of 500 acres in the last two years and is experimenting with various pasture species and methods of establishment. A trial in the use of lime with superphosphate between furrows has so far given pleasing results and will be watched with interest. Mr. Waugh has found that he can re-establish native-grass cover on sheet-eroded country by shutting up an area for a full season, provided there is still sufficient seed available.

Spillway at end of a diversion bank on Mr. H. T. Yencken's property, Mansfield. Water flows into the shallow excavation, then passes over the level spillway (left) which is kept well grassed by fencing out all stock.

Mr. E. O. Bidstrup has a large property of over 3,000 acres of undulating country on the Sugarloaf Creek. Part of the property is of basaltic origin where the erosion hazard is low, but on the soils derived from ironstone, erosion is extensive. He has ploughed 150 acres of contour furrows, constructed three large diversion banks for the prevention of gully erosion, and placed log structures in a gully as soil-saving dams. These are likely to fail because spillway provision is

ineffective. Mr. Bidstrup has also broken down some tunnels and filled in a gully with a bulldozer.

Mr. R. A. E. Harding's property is on the Sugarloaf Creek. It is also partly basaltic and partly ironstone country. On the latter an area of 80 acres of contour furrows has been

Treatment of tunnel erosion on Mr. E. C. L. Head's property, "Mundara," Seymour. Upper picture, tunnels before treatment; lower, tunnels broken down, land ploughed, contour-furrowed and sown to grass.

ploughed, and an effective diversion bank constructed around a gully head which has been battered and sown down. Some very interesting pasture development is in hand within the furrowed area. With a minimum of working on bare sheet-eroded hillside, subterranean clover has been established. Wimmera rye grass is to be added this year.

SEYMOUR SHIRE

Mr. E. C. L. Head was awarded the Seymour Shire prize. This competitor has made a major effort within the last two years in arresting erosion on the hilly portion of his property at Tallarook. This is typical ironstone country. Mr. Head has contour-furrowed about 100 acres, constructed a series of diversion banks to prevent headward erosion, and has so far succeeded in spreading the water so diverted into the contour-furrowed system.

Tunnels have been broken down and the area sown to grasses and clovers. Although some additional and detailed work is required here, the results so far are very good. The most interesting feature, however, is the experimental work in pasture establishment between furrows. An area was fenced in and several manurial and seeding trials are in progress. In all cases the soil between the furrows was only lightly worked with the disc harrow. To date the addition of lime seems to promise well and the use of molybdenum is being tried out this year. *Phalaris tuberosa* is developing well on this bare sheet-eroded area.

Mr. S. C. Shelton, Avenel, has reached a stage in arresting erosion on his property where he can now concentrate on pasture development. The first paddock in this programme has grown a crop and is being sown to pasture this year. Mr. Shelton's contour furrowing, gully and tunnel control work continue to give satisfaction. His habit of feeding grass hay to stock along the contour furrows has resulted in a good development of pasture. Mr. Shelton has recently constructed two dams for flood retention purposes, and the water is subsequently emptied along channels and used for irrigation purposes.

Mr. R. J. Wilson, Violet Town, has built a "dozer" blade on to his tractor for the express purpose of dealing with severe gully erosion on his property. He has already built several gully dams and diverted the water, and is making a major effort by mechanical control on some very steep tunnelled and gullied country.

(continued on page 350.)

Irrigated Pastures in Victoria

By A. Morgan, B.Agr.Sc., Senior Irrigation Officer

Parts 1, 2 and 3 of this series appeared in the March, May and June issues of the Journal.

PHALARIS TUBEROSA

The acreage of irrigable land planted with this grass is very small compared with perennial rye grass, cocksfoot and paspalum.

For details of history, nomenclature, botanical characters, and a summary of useful agricultural features of this grass under dry farming conditions, see No. 2 of the series "Pasture Plants of Victoria" (W. D. Andrew), which is obtainable free of charge from the Department of Agriculture, Melbourne.

In regard to experimental work on the competition effects of perennial rye grass, &c., on Phalaris, the results obtained at the Waite Research Institute and published in the Journal of the Commonwealth Scientific and Industrial Research Organization may be consulted—these were published prior to the war. Chemical studies of the plant were also published by C.S.I.R.O. at that time.

Under irrigation, Phalaris has not been sown to any extent to date, considering the total area of irrigated pastures in the State. From the field trials conducted by the Department of Agriculture at Swan Hill, Cohuna, Kerang, Tragowel, Appin, and also in other centres in the Goulburn Valley, it is clear that Phalaris cannot be recommended for the poorer soils in these areas. The greatest development of the annual species of these "Canary grasses" (Phalaris species) as volunteer growth is in the flood country, and the plants which have been grown on "plain" land have not been particularly attractive. In connexion with soil types suitable for Phalaris tuberosa, it is interesting to note that, according to Mr. Andrew, who was associated with the Victorian Pasture Improvement League experimental work for a number of years, it is particularly suited to the heavy black soils and the self-mulching, deep red volcanic loams. The self-mulching phase of Tragowel clay, which occurs along the natural waterways in the Kerang-Boort-Pyramid area, has been shown by recent trials to be particularly suited to Phalaris tuberosa.

Phalaris may be used in place of Wimmera rye grass in association with subterranean clover, but the seeding cost is very high in comparison with the benefits derived from the more permanent grass-clover balance.

Further, there is the greater risk of a poor germination (due to soil and moisture conditions not being entirely favorable) than with the Wimmera rye grass. There appears to be, in the northern irrigation areas, very little hope of a poor "strike" being rectified by the establishment of new plants from seed dropped by the original plants—in this respect, Phalaris is akin to

Toowoomba grass (Phalaris tuberosa, L.).—Note the long cylindrical head, portion of perennial root-stock, and transparent ligule at the junction of leaf and stem. *[After Breakwell.*

lucerne. A poor strike means re-sowing by one means or another. It is important that Victorian-grown certified seed be used.

A pound of seed contains approximately 350,000 seeds, so that a sowing of 1 lb. per acre, if all the seeds germinated, would give a population of eight plants to the square foot. An establishment of much less than this would eventually provide quite good ground-cover, however, because the plants enlarge laterally each year by means of short underground stems, and old plants may be 18 inches or more in diameter.

As pointed out earlier, the experimental work in regard to yield, &c., of irrigated pastures at the State Research Farm, Werribee, was conducted exclusively on the rye grass-cocksfoot-white clover mixture, and no figures are available from this source for the Phalaris-white-clover complex.

The following table shows results obtained in Gippsland.

PASTURE-TYPES.—PLOTS ON THE PROPERTY OF R. RAUTMAN, TINAMBA, 1939–40.

(Motor-mown.)

Mixture (Lb. Seed per Acre).	Lb. Dry Matter per Plot (Mean of Duplicate Plots).	
	A.	B.
Perennial rye grass 10 + New Zealand White Clover 2 ..	48·1	41·8
Perennial rye grass 5 + cocksfoot 4 + New Zealand White Clover 2	45·2	41·3
Perennial rye grass 5 + Paspalum 4 + New Zealand White Clover 2	49·3	38·1
Perennial rye grass 5 + lucerne 3 + subterranean clover 2 ..	34·9	32·8
Phalaris 4 + lucerne 3 + subterranean clover 2	37·4	32·9
Perennial rye grass 5 + cocksfoot 4 + perennial red 2 ..	42·6	37·6

NOTE.—A. = watered three-weekly. B. = watered six-weekly.

It will be seen that the Phalaris in the above experiment gave production equivalent to perennial rye grass.

Phalaris does not always combine well with perennial rye grass, as the root system of the rye grass develops faster, and only very light seedings of the rye are practicable in a mixture of the two grasses. In association with lucerne, it is objected to by some people, because of the different growth-rhythms (winter and summer respectively) of these species, which make the grazing management difficult in punishing one species or the other unduly.

The plant is obviously drought-resistant, and, in addition, has been known to survive flooding for several weeks. In view of these characters, the trials recently commenced at the various centres which receive irrigation supplies from Waranga should demonstrate whether the grass has a special value for districts in which water supplies are limited, or where the intervals between irrigations are of necessity longer than ten days in January and February.

PASPALUM

It is not often that a plant in such common use as paspalum is referred to by its botanical name; possibly this usage arose from the fact that the plant first assumed importance as an unwanted species in thinned-out lucerne stands. As there are, according to Ewart's "Flora of Victoria", nearly 200 species of the genus Paspalum spread through the tropical and temperate regions of the world, and including both annuals and perennials, a brief description of the species found in Australia appears to be necessary.

Brief description of some of the Paspalum species

The two most common species of Paspalum in Victoria are "Paspalum" (*Paspalum dilatatum*) and "Silt Grass" (*Paspalum distichum*), the latter being well and unfavorably known in the northern irrigation districts for its capacity to block up irrigation channels and drains. Another species, which has been studied in detail by the C.S.I.R.O., is *Paspalum scrobiculatum*; the nearest tests with it at present are being carried on at the C.S.I.R.O. station at Deniliquin, while trials in Queensland have been described in a bulletin. In order to secure supplies of seed, the grass was grown in rows and the machine found most successful was built on the vacuum-cleaner principle.

Two more species—*Paspalum brevifolium* (P. tenuiflorum), which might be called "Short-leaved Paspalum," and *Paspalum minutiflorum* ("Small-flowered Paspalum") have been described by J. H. Maiden in "A Manual of the Grasses of New South Wales", pp. 22–23.

Another fairly common grass in irrigation districts, and one which might be taken to be a paspalum, is "Plain Grass" (*Eriochloa punctata*).

The following key will give reasonably accurate differentiation between the various species :—

A. Erect, tall plants, more than two spikes in head—see B.
Creeping plants, only two spikes in head—see C.

B. "Seeds" (spikelets) hairy. *Paspalum dilatatum.*
"Seeds" (spikelets) not hairy. *Paspalum minutiflorum.*

C. "Seeds" (spikelets) sprinkled with hairs. *P. brevifolium.*
"Seeds" (spikelets) not hairy. *P. distichum.*

All species are alike in preferring damp soil and warmth. As the seed of *P. dilatatum* is the only sort available commercially, this species is the only one which has been the subject of experimental work. Harvesting is now done to some extent by header-harvester, where formerly it was hand harvested. The seed is light and bulky, with an average of 370,000 seeds to the pound, and is in general of poor germinability, 80 per cent. of non-germinable seed being permitted, under the Victorian Seeds Act, in seed offered for sale. A good deal of trouble in this regard arises from the uneven ripening of the heads, which takes place from December to April.

The seed, however, has the ability to lie in the ground for a long period without damage, and this property is made use of when it is desired to incorporate paspalum in mixtures with perennial rye grass, white clover, &c. As an example, a successful sowing can be made of lucerne, perennial rye grass, paspalum, white clover, and subterranean clover in autumn. Good growth of the autumn germinating species is secured before the paspalum germinates in the late spring or early summer. It is considered that this mixture, on the medium quality soils in the irrigation districts, where the frequency of water possible is not quite up to the standard desired for the usual rye grass-cocksfoot-white clover permanent pasture, will give good all round grazing if given reasonable treatment in regard to manuring and grazing management.

A very large acreage of the irrigated pasture in Victoria is predominantly *Paspalum dilatatum*. This grass developed through the use of water without manure. With the advent of topdressing, white and strawberry clovers made rapid progress and transformed the poor pastures to a type capable of carrying a cow or more to the acre.

Paspalum dilatatum.
[After N.S.W. Agr. Dept. Bull. No. 59.

While most of its virtue, where it is the subject of praise, would be more correctly credited to the perennial clovers (white and strawberry) with which it is associated wherever topdressing with superphosphate has been practised, there is no doubt about its vigour and ability to spread under irrigation. Further, wherever the management of the perennial rye grass–cocksfoot–white clover pasture is not maintained at a high standard, paspalum will soon become an important element in the mixture. Poor drainage will accelerate its intrusion.

Its disadvantages, which can be minimized by careful management, include the following :—

(1) Negligible winter growth.

(2) Goes rapidly to rank coarse stemmy growth in midsummer.

(3) In some seasons is badly affected by Paspalum ergot.

(4) Chokes up channels and drains in the busiest part of the watering season.

There is also some evidence that it becomes "sod-bound" and requires periodic ploughing or rotary-hoeing, but this practice has not gained much ground in Victoria compared with some areas in New South Wales where it is grown under rainfall alone.

To augment the winter growth of a pasture strong in paspalum, the cheapest and most effective method is undoubtedly the practice of heavy topdressing with superphosphate. If white clover or strawberry clover is not present, they may be introduced by mixing a pound of seed per acre with the superphosphate to be applied, and topdressing in the ordinary way, the choice of the type of spreader being unimportant. This is best done in the autumn or spring, when the soil surface, shaded by plants present, remains moist for a sufficient time for the rootlet to penetrate. In the summer there is a risk that the seed may dry out before it is properly established. If it is desired to add perennial rye grass for better winter feed, this may be drilled or combined or harrowed in, without any great trouble being taken, the main point being to give some slight covering to the seed, and the remarks in regard to season for sowing white clover apply equally well to rye grass. With some clover and rye grass present, topdressing will stimulate further advancement of these species, as the clover responds vigorously to the superphosphate and the rye grass develops in response to the nitrogen accumulation resulting from the strong clover growth. Prairie grass, another valuable winter grass, often becomes a strong volunteer, without any sowing being done, on well "supered" pastures.

To control the coarse stemmy growth of paspalum in mid summer, some mowing is desirable after stock have been taken out of the paddock. If only a few bays are mowed each day, there is a good chance that the stalks, when cured on the ground, will be eaten by dairy cows, but, when a large area is done, most of the clippings are neglected by stock and consequently wasted.

Paspalum ergot (*Claviceps paspali*) has been known in Australia since 1935 (according to A. R. Grayson, B.V.Sc., "Paspalum Ergotism in Cattle," Journal of the Department of Agriculture, Victoria, 1941, page 441). In the same year, states C. S. M. Hopkirk, of the Wallaceville Veterinary Laboratory, New Zealand (N.Z.J.Ag., 1936, page 105), reports were received that cattle were becoming affected with a form of staggering when grazing on paspalum. Quoting from Grayson's article :—

"Continued ingestion of ergot-infested paspalum or couch grass produces the following symptoms in dairy cattle :—Milk secretion ceases and the affected cows lose condition. They become listless in their movements and do not graze readily. In the early stages there may be some diarrhoea, but this is soon followed by a fairly obstinate impaction. Nervous symptoms supervene, and these symptoms are typical of the condition. There will be noticed incoordination of movement as shown by a staggering gait, twitching of groups of muscles, shivering, a degree of lameness with a possible partial paralysis. The temperature, pulse, and respiration remain comparatively normal, but the coat becomes harsh and the eye staring. There may be also a discharge from both the nostrils and the eyes. If disturbed and forced to move, the animal will stagger and often go down, at times falling over backwards. If paralysis is evident, the animal will be unable to rise, and death will supervene from congestion of the lungs, &c.

"Recovery is rapid if the animal is at once removed from the affected pasture. The treatment then consists in the administration of a purgative, such as 1 lb. of Epsom salts and 1½ oz. of ginger to 1 quart of water. This may be repeated if necessary. If recovery is slow, it may be assisted by giving a tonic powder, consisting of 1 dram of sulphate of iron, 1 dram of nux vomica, 2 oz. Epsom salts, and 2 drams of gentian. This powder should be given, mixed with treacle, once daily for three days.

"Ergot-infested paspalum does not give rise to the condition of gangrene of the extremities as does ergot of rye, nor is there any history of it causing abortions."

Among the disadvantages of paspalum in irrigated pasture, its propensity for choking up irrigation and drainage channels has been mentioned. The maintenance of free flow of water in the farm channels is a problem of some magnitude today. Such weeds as cumbungi, cat-weed, *Paspalum distichum*, and rushes are a constant source of trouble, as well as *Paspalum dilatatum*.

The most satisfactory method of dealing with these channel weeds is, undoubtedly the scoop or the drag-line excavator, which removes the roots and gives a trouble-free period of reasonable duration. While the cutting off of the topgrowth of weeds may be a palliative the regrowths are normally so rapid that it is difficult to secure satisfactory irrigation conditions for even one season.

The weed hook, which is used in the Tongala irrigation district to clear drains, has much the same action as the drag-line excavator, but involves considerably more manpower and is probably more expensive and less efficient. One must also take into consideration the present disinclination of farm labour to employ itself on disagreeable jobs. For this reason, the farm equivalent of the excavator—the scoop—is not particularly popular, and with the current leaning towards tractor power as opposed to the use of horse teams, the situation is rendered more difficult. Add to these disadvantages the high wages now required for farm labour and it is not difficult to understand the present unsatisfactory general conditions of farm channels.

The optimist looks towards chemical methods for the eradication of aquatic weeds. Unfortunately, there is no weed-killer available to-day which is either reliable or cheap. The recently developed hormone sprays which are found to be reasonably effective against the dicotyledonous weeds (i.e., those which, on germination, show two cotyledons or seed leaves, similar to trefoil, peas, &c.) are not considered effective against the mono-cotyledonous plants (i.e., those which, on germination, show only one cotyledon or seed-leaf, similar to grasses, cereals, rushes, &c.). Of the older spray substances, some are poisonous, some are inflammable, most are ineffective, and all are too expensive. No specific research on the problem has been carried out, and, in all probability, it will be a considerable time before the suggested research by the C.S.I.R.O. in the Murrumbidgee Irrigation area shows results suitable for application on the farm.

The Flame-thrower

Certain types of flame throwers have been widely advertised for the control of channel weeds. Experiments with these types have been carried out and the following information is given:—

In spite of the high flame temperatures claimed to be reached with some flame throwers, a sufficiently long time of application of the flame to burn such material as paspalum slows down the work of channel-cleaning to such an extent that the labour charge becomes the more important expense. Cat-weed, in our opinion, is not suitable material for treatment by flame thrower. Rushes which have a proportion

Silt grass (Paspalum distichum). Note the running habit of this grass and its resemblance to couch grass. *[After Breakwell.*

of dry material at the base are very satisfactorily dealt with, particularly if a day when the wind is blowing down the channel is chosen. Green cumbungi requires considerable time of application of the flame. With the green weeds, the best plan is to sear them on one occasion, and return with the flame-thrower when they are considered dried out sufficiently for rapid burning.

The sensible approach to the flame thrower is to regard it as a useful tool with very definite limitations. Even where it appears that the burning out is very slight, a noticeable effect on the water-carrying of the channel is usually secured, but, on the other hand, except where only small lengths of channel are to be treated, it is doubtful if the time consumed in flame throwing gives results comparable with those obtained by a similar expenditure of time in cleaning the channels by mechanical means.

A further problem is the suiting of flame-thrower operations to the recently introduced restrictions on the lighting of fires in the summer period.

A further instalment of this series will appear in a subsequent issue of the Journal.

Goulburn Valley Soil Conservation Competition—*(continued from page 344).*

YEA SHIRE

Mr. H. C. Gordon, Murrindindi, wins the award for the best entry in the Yea Shire. During the year he has effectively controlled the further extension of a deep, large gully by using a system of diversion banks. Concrete structures, smaller diversion banks, and contour furrows are among other mechanical works on this property.

SHIRE OF ALEXANDRA

One entry only was received from the Alexandra Shire—that of Messrs. G. G. Foletta and Son of Buxton. This is a well-improved property on the Acheron River. Most of the development has been on the flats and lower slopes where the natural erosion hazard is not high.

SHIRE OF MANSFIELD

Mr. H. T. Yencken, Mansfield, was the only entrant from this shire—an area where erosion is very marked. The retention of natural timber for shade and shelter provides a pleasing feature of this property. The construction of a diversion bank to stop gully erosion provides the most effective diversion seen on any property in the competition. At the spillway, a small dam has been excavated to allow for an even overflow on to a grassed area which is maintained by fencing-out all stock.

In concluding this report on a very interesting competition, I desire to thank all those who, by entering their properties, made the competition possible. Their ready co-operation in supplying particulars of stock carried and details on their general farming operations is appreciated. I thank the Shire Councils for offering prizes, their officers for helpful assistance, and Mr. Harold Hanslow for his ready help and advice.

LIVE STOCK NOTES

Compiled by A. C. T. HEWITT, M.Agr.Sc.,
Live Stock Science Officer

TWO RECORD-BREAKING FRIESIANS

TWO Friesian cows, Ingolston Gwen, owned by Messrs. P. Goodfellow and Son, Bunyip, and Victoria Olga, bred and owned by the Department of Agriculture, produced over 900 lb. butterfat in the 1948–49 Victorian Standard Herd Test.

Ingolston Gwen, born on 20th August, 1939 was nearly nine years old when she commenced her record-breaking performance, producing 26,601 lb. milk (3·45 per cent. test) and 917 lb. butterfat in the 273 days of the test. She was milked twice a day throughout, and finished the year producing 67 lb. of milk a day. In her previous lactation she produced 19,940 lb. milk (2·91 per cent. test) and 580 lb. butterfat.

Victoria Olga, two years younger, was born on 19th October, 1941, and completed her record with 25,353 lb. milk (3·57 per cent. test) and 905 lb. of butterfat. She was milked twice a day for two months and then thrice a day, finishing well, giving 68½ lb. of milk per day. In her previous lactations she produced 13,758 lb. milk, (3·15 per cent. test) and 433 lb. butterfat as junior-two-year-old, 14,853 lb. milk (3·41 per cent. test) and 506 lb. of butterfat as senior three-year-old and 19,923 lb. milk (3·54 per cent. test) and 705 lb. butterfat as a mature cow.

These cows are two of four which have produced over 900 lb. of butterfat in a 273-day test in Victoria. The other two were the Jersey, Banyule Tiddlewinks 26th, with 935 lb. of butterfat and the Guernsey, Yarraview Le Mode, with two outstanding yields of 976 and 963 lb. of butterfat. The previous highest-producing Friesian was Springfield No. 9 which produced 860 lb. butterfat.

[A.C.T.H.

LIVE STOCK STATISTICS FOR VICTORIA

Live stock statistics for Victoria to 31st March, 1949, have been released by the Victorian Government Statist. Dairy cattle during the year increased by 36,913, and advances occurred in the number of all classes of dairy cattle with the exception of calves. Calf numbers declined by more than 4,000 compared with the previous year's figure. The big increase of nearly 50,000 in the number of milking cows no doubt was due largely to the very good season which enabled more cows to be milked for a longer period into the autumn.

Dairy Cattle Numbers in Victoria, 1944–49.

—	31st March, 1949.	31st March, 1948.	31st March, 1947.	31st March, 1946.	31st March, 1945.	31st March, 1944.
Milking cows	688,514	639,079	646,823	629,046	591,437	611,599
Dry cows	241,738	257,807	230,382	182,353	267,763	263,197
Springing heifers	80,266	78,452	78,935	71,247	66,107	63,688
Other heifers	224,529	220,122	174,196	200,855	201,158	211,317
Calves	239,457	243,613	245,783	181,170	202,258	218,970
Bulls	38,788	37,316	35,509	35,098	35,479	37,257
Total ..	1,513,292	1,476,379	1,411,628	1,299,769	1,364,202	1,406,028

Live Stock Statistics for Victoria, 1944–49.

Horses	213,090	221,454	227,164	232,473	253,782	277,662
Dairy cattle	1,513,292	1,476,379	1,411,628	1,299,769	1,364,202	1,406,028
Beef cattle	711,251	697,824	648,433	527,318	538,908	607,005
Total cattle ..	2,224,543	2,174,203	2,060,061	1,827,087	1,903,110	2,013,033
Pigs	223,823	271,492	290,450	271,887	296,232	337,878
Sheep	19,170,312	17,931,173	16,598,490	14,655,277	16,457,101	19,220,457

Horse numbers continue the progressive and rather steep decline noticeable over the past quarter of a century.

The decrease in pig numbers by approximately 50,000 during the year represents a loss of 17·5 per cent. on 1947–48 figures. The smallest drop occurred in the Central and Northern districts (12 per cent.) which gives some indication of the food supplies available in those localities. In the Central district large numbers of pigs are fed on kitchen refuse. In the Northern district ample supplies of skim milk have been available, because butter production in that locality has not been affected by any change-over to processed whole-milk production. The greatest decline in pig numbers occurred in the Wimmera and Mallee where there are now 30 per cent. fewer pigs than last year. High prices ruling for grain have evidently been sufficiently attractive to discourage pig farming in those districts.

Sheep numbers throughout the State continue to increase and the present figure—19,170,312— is rapidly approaching the 1942 record of 20,598,201. A scrutiny of the sheep figures reveals that the proportion of ewes mated to Merino, Corriedale, and Polwarth rams has increased considerably during the year. Against this there was a decline in the use of rams of all British breeds except Dorset Horn, which showed a slight increase. The mating of ewes and the use of rams shows a tendency among sheep owners to go over to wool production.

VICTORIA'S PIG POPULATION

The pig population of Victoria at March 31st this year was 223,823, the lowest figure since 1929, when there were 222,084 pigs in the State. The highest figure ever attained in Victoria was reached in 1941 when there were 397,945 pigs.

The accompanying graph indicates that declines in the pig population similar to the present one have occurred several times previously. Considering past experience and present circumstances affecting the pig industry in Victoria, it is likely that the pig population will remain near its present level for another year or two and will then gradually increase.

The conditions which have led to the present decline in the pig population include the unfavourable ratio of pig prices to grain prices, the change in some districts from selling cream to selling whole milk, shortages of materials and labour required for pig production, and the relative prosperity of farmers who obtain most of their income from commodities other than pigs.

When the prices of pigs and the prices of other farm products approach more closely to one another through a decline in the prices of those other products, pig production will undoubtedly increase.

[L. A. Downey, H.D.A., Pig Expert.]

PURE-BRED BULL DISTRIBUTION PLAN

During 1948–49, 176 bulls were placed through the Pure-Bred Bull Distribution Plan with dairy farmers unable to finance the purchase of a pure-bred bull direct from a breeder. Most dairy farmers participating in the assistance given under the plan had recently gone into dairy farming through the Soldier Settlement Commission.

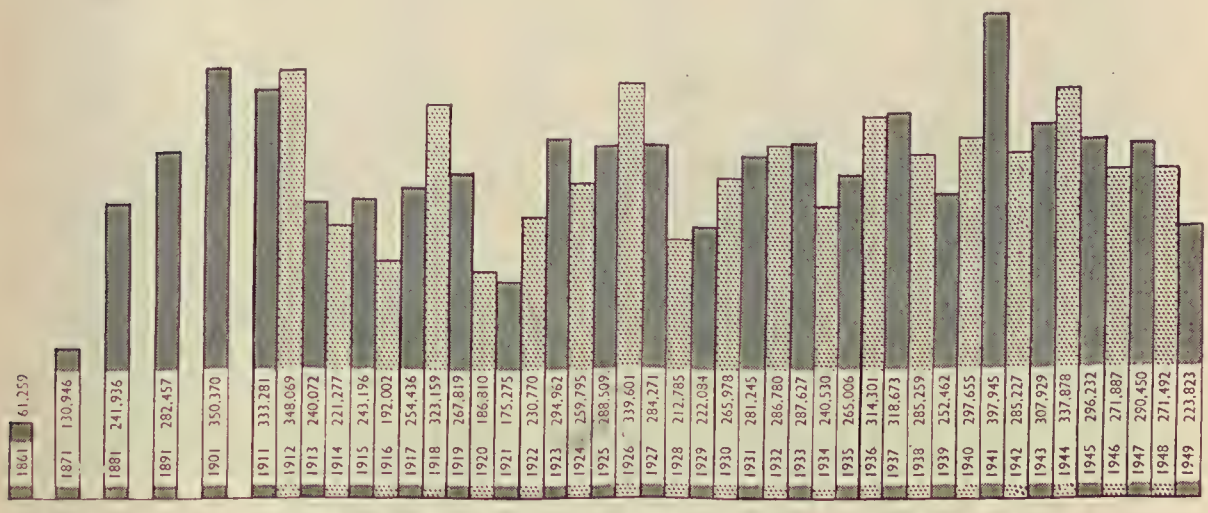
Bulls of good conformation and from high-producing dams were readily available from all breeds with the exception of Guernseys, but in comparison with 1947–48 the bulls were on the average two months older and were from dams which produced 3 lb. more butterfat.

There was an increased demand for Jersey and Friesian bulls.

Breeds Allotted, 1948–49, Under the Pure-Bred Bull Distribution Plan.

—	Number of Bulls	Average Age	Average butterfat Yield of dams
		months	lb.
Australian Illawarra Shorthorn ..	6	10	365
Ayrshire	3	13	334
Dairy Shorthorn ..	7	7	353
Friesian	12	9	390
Guernsey	8	10	387
Jersey	131	11	428
Red Poll	9	15	391
Total ..	176		
Average ..		11	416

Some of the bulls were from dams producing up to 647 lb. of butterfat, but as so many purchasers desired bulls of serviceable age,



Rises and falls in Victoria's pig population over the past 89 years.

numbers of bulls over 12 months old from lower-producing dams were distributed.

—	Number of Bulls Allotted
Bulls from dams producing under 300 lb. of butterfat	10
Bulls from dams producing 300 lb. to 400 lb. butterfat	62
Bulls from dams producing 400 lb. to 500 lb. butterfat	79
Bulls from dams producing 500 lb. to 600 lb. butterfat	22
Bulls from dams producing 600 lb. of butterfat or more	3
Total ..	176

Of the above bulls, eight were under three months old; 22 were between three and six months old; 28 were between six and nine months; 40 were between nine and twelve months, and 78 were over one year old.

Particulars of the plan may be obtained on application to the Superintendent of Live Stock, Department of Agriculture, Melbourne, C.2. [A.C.T.H.

DAY-OLD CHICKS

The first week is the most critical in a chicken's life and its removal from incubator to brooder should be carried out carefully and expeditiously. In most cases, the troubles arising between hatcheryman and chick purchaser are due to incidents which occur at this time. Newly-hatched chicks are very sensitive to drastic reductions in temperature or to poorly-ventilated environment.

After they are hatched, the chicks are removed from the incubator where the temperature is approximately 100° F. and transferred to the brooder where the temperature varies from 90° F. to 95° F. Prolonged

The seven prize-winning carcasses in the Australian Meat Board's Victorian bacon-pig competition displayed by Messrs. Wm. Angliss & Co. after curing.

(continued on page 368.)

ORCHARD PEST CONTROL

Overseas Developments in Spraying Equipment

Observations made by Frank M. Read, M.Agr.Sc., Chief Inspector of Horticulture, during a visit last year to England and North America

UNTIL very recent times little change occurred in the generally accepted idea that, for pest control in horticultural crops, the portable spray plant was the normal thing to use, spray materials being applied through rods or guns from rubber hoses directed by hand. The main departure from this practice, prior to 1940, was the stationary spraying plant in which, from a centrally placed mixing point on the orchard, spray materials were conveyed under pressure through a permanent reticulation of pipelines to feed hand hoses similar to those used with the portable sprayer. Occasionally the portable sprayer has been used for mixing and as a source of power at any point along the orchard roadways, temporary portable pipelines being run from it to supply the spray material to the hoses.

Fig. 1—A typical portable English orchard sprayer.

It is doubtful if any new method will be evolved which is biologically superior to established hand methods, when carefully applied, and throughout the world such equipment is still the type that most orchardists are using. Fig. 1 shows a typical English orchard sprayer. In England, Holland and America such machines are usually capable of maintaining, if necessary, upwards of 600 lb. per square inch—a much higher pressure than the Australian orchard plant can hold, and the output of spray is greater, ranging from 20 gallons to up to 40 and 50 gallons per minute.

Frequently, spray "brooms" (Fig. 2) are used in place of the guns or single jet rods customary in Victoria. At the Essex Institute of Agriculture, I saw the splendid equipment shown in Fig. 3 designed to study the best spacing on the brooms of jets of the various types and to demonstrate the results to orchardists. Water was delivered to the jets at normal working pressures from a portable orchard sprayer. The large canvas shield and trough enabled the water to be pumped back into the spray vat and used over again. It was the most efficient apparatus for such a purpose I have seen anywhere.

However, the labour situation in the countries visited, as in Australia, is such that growers are finding it increasingly difficult and, in many places, impossible to engage sufficient skilled labour for this work. Generally, too, the cost of labour has increased so greatly that growers are looking to a greater degree of mechanization to reduce the cost of pest control.

Prior to leaving Australia, I had been broadly familiar with the published descriptions of new machines evolved abroad in the last five years and expected to find the answer to our problems in one or more of the machines already in use. In the opinion of the many knowledgeable people

Fig. 2—A four-jet, spray "broom". Some have even more jets.

I met, this is not the case. The horticultural world in this regard is in an interesting stage. Many good machines have been sold commercially, but none is yet the product of sufficient research to make it wholly satisfactory.

As a result of the practical experience gained and the intensive investigations carried out in the last couple of years, it is generally felt, however, that enough information is now to hand to consolidate the undoubted advances made since the war and develop satisfactory automatic spray machines. The biggest manufacturers of such equipment in America told me that they hoped this period of uncertainty would soon be over because, at present, the production of new types was a hazardous venture.

Fixed Jets and Spray Masts

The idea of using a machine with fixed jets which will automatically direct spray at the plants as it travels along the row is not new. Trellised vines, for instance, have been sprayed for a long time with such equipment, but in recent years there has been a definite move to apply the principle of fixed jets to orchard spraying. Fig. 4 shows a machine in use on a large English orchard, but I did not regard its work as being altogether satisfactory.

The best machine of this type in England is the experimental one designed by Dr. Kearns of Long Ashton Research Station illustrated in Fig. 5. Though this machine has been used to spray the Long Ashton Station orchards and has performed the work with one operator twice as quickly as the orthodox method using two hoses operated by hand, it is not yet as biologically efficient as the orthodox plant illustrated in Fig. 1.

Dr. Kearns said that one difficulty was the varying shape of trees which called for masts of different sizes and carried at different angles. He proposes to try, this year, a mast with a crosspiece at the top so that some spray can be directed downwards as well.

An important point is that only machines capable of maintaining a pressure of at least 600 lb. per square inch and an output of not less than 40 gallons per minute are suitable even for trial of such automatic methods if the machine is to travel at a reasonable rate, say, 1½ miles per hour and really cover the trees.

The spray mast on Dr. Kearns's machine is in the form of a triangle with a height of 9 feet and a spread at the base of 3 feet. The base can be adjusted to any height between 18 inches and 4 feet above ground level. There are nine jets on each side, the lowest five being 18 inches apart and the highest five 9 inches apart. The direction of the top five is adjustable. The jets had an aperture of 6/64ths and a

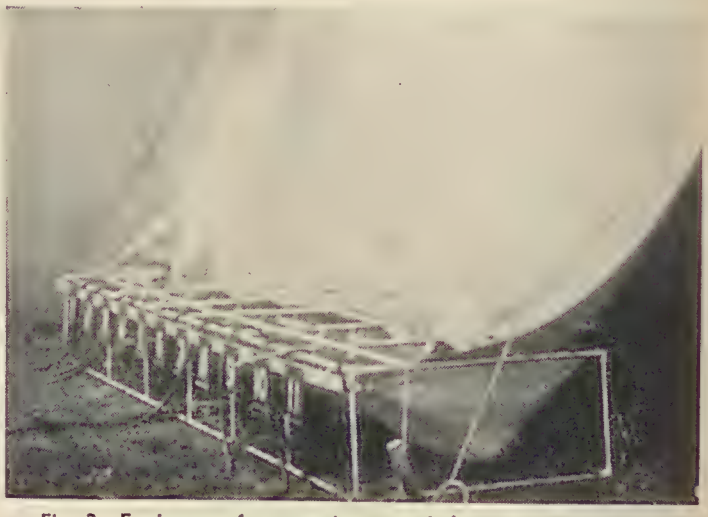


Fig. 3—Equipment for experiment and demonstration in the design of spray jets and "brooms".

six-hole swirl plate. The spray is at present fed into the mast at the bottom, but it would be preferable to feed it in half way up to obviate the tendency for starvation of the top jets.

Pest Control Ltd. in England use the machine illustrated in Fig. 6 to perform contract spraying of orchards. The advantage of using the outrigger device for large spreading trees is considerable, but this machine would be too costly for an individual orchardist.

A typical American machine using a spray mast is illustrated in Fig. 7. It is capable of maintaining an output of 48 imperial gallons per minute. It has a 480-gallon tank and an engine capable of developing 45 h.p. The mast is equipped with seven drive-type guns and the machine is claimed to spray up to 40 acres of mature trees in one day.

Broadly, I formed the impression, however, that such spray masts were not likely to be the final answer to the problem of automatic spraying unless the shape of the trees had been made to conform to the machine's requirements by training them in the form of flat walls, as in the case of espaliers and cordons.

Fig. 4—A fixed-jet sprayer in an Essex orchard.

The Long Ashton Research Station, when I was there, was preparing to grow an orchard of trees in this fashion and from this, orchardists will gather that their colleagues in England are prepared to consider making striking changes in tree management to achieve the goal of efficient fixed jet application of spray materials.

In the citrus industry, spray masts are not favoured, spraying being performed by a portable spray machine usually with two hoses operated by hand at ground level and one hose directed by hand from a hydraulically elevated platform as illustrated in Fig. 8.

Fig. 5—The fixed-jet sprayer designed at Long Ashton Research Station, Bristol University.

AIR-CARRIER EQUIPMENT

Much publicity has been given in Australia in recent years to accounts of the development in America of spraying machines in which the spray material is delivered into a blast of air where it is finely atomized and carried through the foliage of the trees as a mist as the machine is driven between the rows.

The "Speed Sprayer"

The "Speed Sprayer" illustrated in Figs. 9 and 10 is used very widely throughout the United States of America and Canada. The larger of the two models seemed to be the one favoured. It has a tank of 400 gallons capacity from which spray material is delivered at a pressure of about 60 lb. to the square inch to jets placed around the

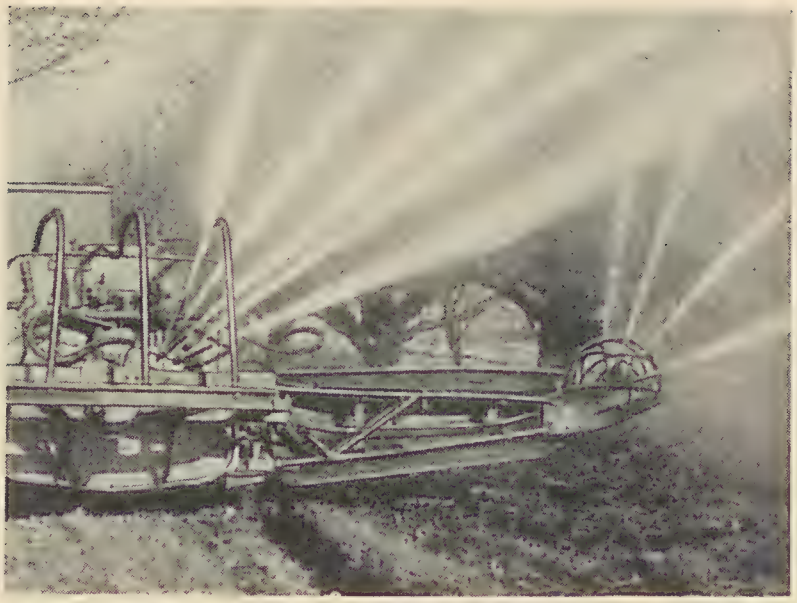


Fig. 6—An automatic sprayer for large-scale contract spraying in England. The spray nozzles oscillate when in use.

periphery of the air outlet—(Fig. 11). The standard number of jets is about 80, the standard nozzle delivering 4/5ths of a gallon per minute, giving a total spray output of 65 gallons per minute. However, the number of jets may be increased to a maximum of 130 or reduced to the lowest number desired. The aperture, too, can be varied in each jet, and this gives further control of the volume of spray.

The air stream is provided by a 36-inch diameter fan revolving at over 2,000 R.P.M. and delivering between 40,000 and 45,000 cubic feet of air per minute at a velocity of 85 to 90 miles per hour. It is powered by a six-cylinder 110 h.p. Hercules engine. By a simple adjustment the machine can be made to deliver to jets all around the periphery or to jets on one side only, and, in my observations, the latter was the grower's most usual method. At the standard rate of discharge, the 400-gallon tank was emptied in six to eight minutes and the economical use of the Speed Sprayer depends considerably on having a refilling unit with a 400-gallon tank and a pump capable of transferring the refill rapidly to the Speed Sprayer.

The cost of the Speed Sprayer with the supply tank mounted on a second-hand truck and with a quick-acting refilling pump would be, in America, about £2,000. The weight of the machine empty was 5,700 lb. and necessitates the use of a large tractor. It would, therefore, not be suitable for a small orchardist, although the speed of spraying would enable it to satisfy the requirements of several small orchards.

When first used, it was assumed that the capacity of these machines and their method of application permitted them to be driven at a ground speed of three to four miles per hour, and I saw growers still using them at this speed. They are not, however, satisfactory when driven at more than about one mile per hour.

The important principle seems to be emerging as a result of experience that the ground speed of the machine can be no faster than will permit air to be discharged while

Fig. 7—An American fixed-jet machine.

Fig. 8—A Californian spraying tower hydraulically elevated from the portable sprayer.

the machine is passing a tree equal to the volume of air contained in that tree and displaced from the tree by spray-laden air from the machine. Probably a somewhat higher volume of air than this is necessary in order to overcome the resistance of the foliage and branches.

If a simple calculation is made of the volume of air contained within trees of different sizes, it will be seen that the effective limit of rate of travel of this machine when dealing with large trees, is surprisingly low.

Large trees planted 30 feet apart would seem to need a machine of about twice the output of the Speed Sprayer in order to work efficiently at a ground speed of 1 to 1½ miles per hour. However, in most Australian orchards, because our trees are smaller, 1 to 1½ miles per hour could probably be maintained.

In trials made in Australia of air-carrier machines, this new conception needs to be borne in mind. I know of no commercial machine of higher air output than the Speed Sprayer.

Another important generalization that seemed to be widely accepted, although I do not think it has yet been published in the United States, is that the velocity of the air, contrary to previous opinions, does not need to be high, a rate of movement of 10 to 15 miles per hour perhaps being quite adequate if high volume is available. High-volume low-velocity air movement is broadly the objective now for such machines, as contrasted with lower volume and higher velocity on which early emphasis was incorrectly placed.

Silveraire Sprayer

The machine illustrated in Fig. 12 also works on the air-carrier principle. I had no opportunity of seeing the Silveraire machine in use, but understand that the volume of air used is much lower.

Like the Speed Sprayer it has a 400-gallon tank and an output of 40 imperial gallons per minute of spray material at a pressure of 70 lb. per square inch at the jets. In this case, the spray jets open from a pipe across the centre of special spray nozzle heads through which the air blast is directed, and these nozzle heads can be oscillated mechanically by the operator so that the direction of the blast may be varied from top to bottom of the trees as the machine moves forward or, if preferred, left in any fixed position, either on one side only or covering both sides of the row.

Concentrate Sprays

From a practical point of view, rapid refilling of such units several times an hour when applying sprays of conventional strength is a problem. It is now realized that the full

Fig. 9—The "Speed Sprayer" machine, one of the air-carrier types of orchard sprayers which have gone into wide use for pest control in U.S.A.

Fig. 10—Rear view of "Speed Sprayer" showing 36-inch fan and spray jets in action.

advantage of such machinery in reducing labour and spraying costs depends in considerable measure on the use of concentrated sprays which would enable very much smaller gallonages to be applied per tree and per acre and greatly extend the period between refillings of the tank.

Dr. A. D. Borden of the California University has recently shown that for DDT spraying of deciduous fruit trees the sprays may be concentrated so that 250 trees may be sprayed per tank of concentrate spray, as compared with 20 to 25 trees per tank with the standard bulk spray, without reducing efficiency.

The deposit on the leaf was found to be actually higher where the low volume of concentrated spray was used and the cost of spray materials per acre was reduced to one-eighth of the cost of the materials used in bulk spraying. Since the machine went between refills for about an hour, as compared with a bulk spraying interval of eight minutes, a great saving in labour can also be effected. Thus, the great advantages of such new machinery will be fully exploited only when entomologists, chemists and spray manufacturers have had time to devise and offer for sale a range of concentrate sprays.

Mist Dusters

We have seen already in experimental trials in Victoria the Buffalo turbine machine, and the Bean "Mist Duster" is another machine of similar type (Fig. 13). This model is double-sided with a fish-tail nozzle 40 inches long and 3 inches wide directed to either side and capable, it is said, of treating from six to fifteen acres per hour, depending on tree-spacing and tractor speed.

A smaller, single-sided machine capable of spraying three to seven-and-a-half acres per hour is also manufactured. Both the Buffalo and the Bean have relatively small spray tanks of up to 100 gallons capacity but, if used with the newer type concentrate sprays, carry sufficient material to spray, say, ten acres of orchard. As they are fully automatic, they can be operated by one man driving the tractor.

The Bean blower delivers a blast of 8,000 cubic feet of air per minute at a velocity of 120 miles per hour, and is said to be driven from three to five miles per hour. It is hard to see how, on these figures, such machines can satisfy the requirements for efficient spraying suggested earlier, namely, that a large volume of spray-charged air, equal to the volume of the trees sprayed, is necessary for efficient coverage. I gathered the

Fig. 11—Close-up view of some of the spray jets which feed into the air blast of the "Speed Sprayer".

impression that orchardists do not regard such machines in their present form as having proved themselves generally capable of replacing the conventional high-pressure spray machine with hand-directed hoses.

I should think the machines would be used more effectively as dusters than as mist sprayers in their present forms. The illustration does not show a dust hopper, but this can be easily attached to the machine and dust fed into the air nozzle instead of spray material through the spray jets. I enquired whether dusting machines, which might even further reduce the weight of material applied per acre, should not be considered, but American opinion seems to be definite that dusts are not indicated for general orchard use.

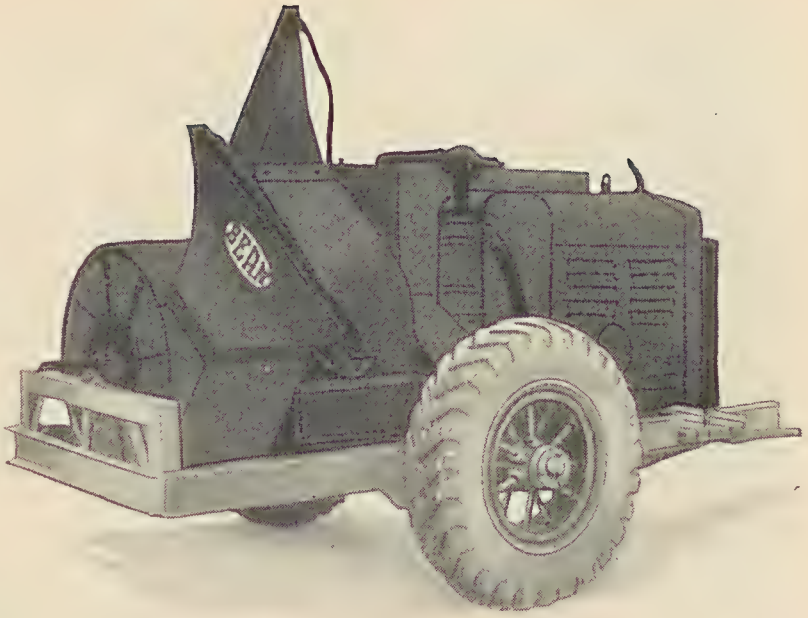


Fig. 13—The Bean "Mist Duster" is designed for use either as an orchard duster or as an air-carrier wet sprayer.

Aerosol-type Ground Machines

There is appreciable interest in America in the further development of machines which will use a highly-concentrated aerosol-type of spray vaporized by heat and blown as a fog, or where steam heating is used as a mist, into the tree. We have seen the "Tifa" smoke generator-type of plant in Australia and Fig. 14 illustrates the "Bes-kil" steam generator-type, of which I saw a number on the west coast of America.

The "Bes-kil" machine consists of a water tank to supply steam and the aerosol spray tank, liquid from both tanks passing independently to the heating unit for vaporization.

The oil burning heater maintains a temperature of 350° F. and each tank has a pump capable of delivering 80 gallons per hour. The tanks are of about 50 gallons capacity, and at a ground speed of 2½ miles per hour the machine is designed to cover three to four acres per hour, being driven up and down each side of each row. It needs to be used in perfectly still air, and most growers did not regard this method as satisfactory. However, Dr. Glover, Entomologist of the Shell Company's Research Station at Modesto, California, thinks that there are definite possibilities in this form of application with an objective of using concentrated sprays at the rate of about 5 gallons per acre and particle sizes of 10–30

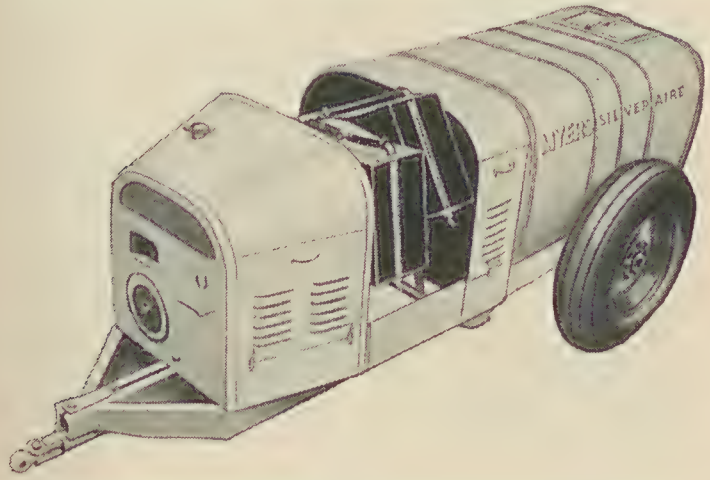


Fig. 12—The "Silveraire" air-carrier spray machine with oscillating nozzle heads.

Fig. 14—A "Bes-kil" aerosol mist machine.

microns. At that Station a new fog machine, of which only the first experimental machine in the rough had been made, with a heating unit capable of maintaining 1,200° F., is said to be already much more satisfactory than previous machines of this type. A typical application by this machine would be one pint of tetra ethyl pyro phosphate in two gallons of diesel oil per acre. The smoke is directed at the ground and rises into the tree.

Combination of Air Carrier and Aerosol Fog Principles

At the Dominion of Canada Entomological and Chemistry Laboratories, Summerland, British Columbia, under Dr. James Marshall, a new idea has been developed which was regarded in Canada and the United States by all the workers I met as the outstanding recent contribution to the problem of design of orchard pest control machinery.

In an article which appeared in the Proceedings of the Washington State Horticultural Society for 1947, Marshall and Miles stated that the investigation, then in its second year, had shown that light high-speed sprayers using entirely organic insecticides and miticides developed within the previous five years, had been able to control the most serious apple pests of British Columbia. They indicated that dusts were definitely not promising for this purpose however applied.

Steam aerosol generators and the hydraulic types of ground sprayers or sprayer dusters gave variable results, though the latter machines, when suitably modified, were perhaps capable of good results, and of the aerosol generators it was thought that they would be vastly improved by the addition of a suitable blower.

The experience gained in those trials enabled the British Columbia workers to set down the undermentioned characteristics of what would be, in their opinion, a thoroughly satisfactory new type of machine which would supplant the spray machinery used by horticulturists in the past :—

(*a*) Capacity to spray an acre in 30 minutes or less and give reasonably uniform coverage.

(*b*) Operation by one or two men, one of whom will drive the tractor. Both operators will be seated when at work.

(*c*) Weight less than 3,000 lb. loaded so that it may be readily hauled by a light tractor.

(*d*) Low construction and low centre of gravity to give stability on sidehills and allow ready passage through densely planted orchards.

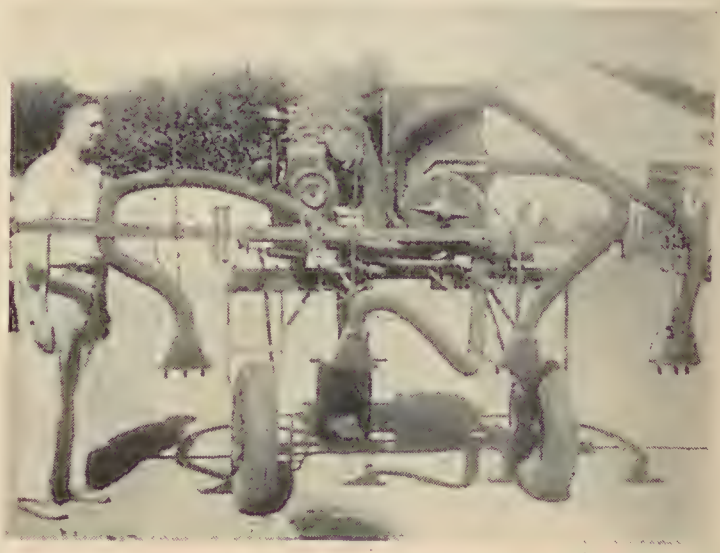


Fig. 15—Air-carrier type row-crop sprayer designed at the Shell Company's Research Station, Modesto, California.

(*e*) Mounted on four " staggered " airwheels or similar small pneumatic wheels or on " crawler " tracks to give easy riding qualities and to avoid unnecessary compaction of the orchard soil.

(*f*) Operating by means of an insecticidal fog carried in a high-velocity airstream probably directed at right angles to line of travel. The insecticidal fog will be produced either by steam or by hydraulic pressure.

(*g*) Using concentrated spray mixtures, i.e., 15 to 50 gallons per acre.

That is to say, they visualized a machine combining the principles of the aerosol machine and the air-carrier machine, and they expressed the opinion that the conventional high-pressure spray plant now used by horticulturists throughout the world might possibly meet the requirements of a high-speed, concentrated spray application, such as they visualized if a suitable blower unit were added. Such modifications to existing spray equipment would obviate the heavy financial loss involved in scrapping it in favour of completely new equipment.

Fig. 17—A helicopter spraying an English orchard of dwarf pyramid apples.

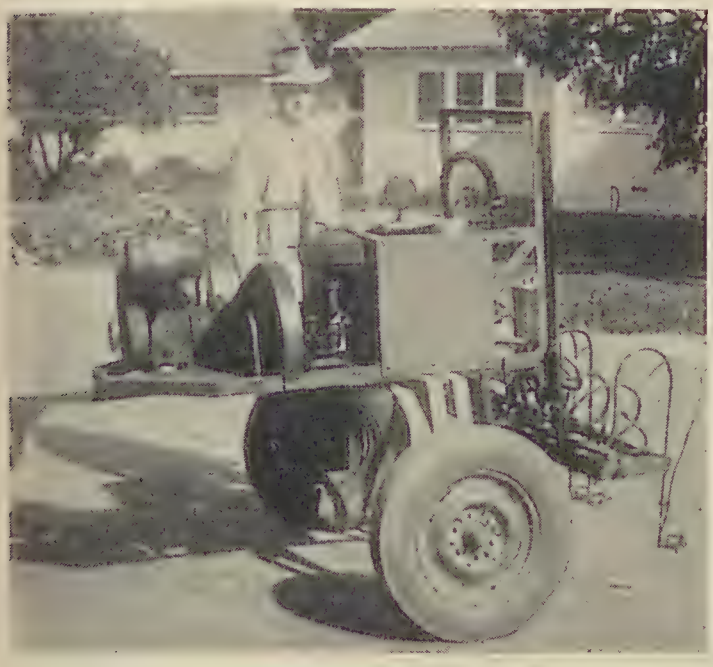


Fig. 16—Air-carrier precision row-crop sprayer for exact work in small-scale trials of spray materials in, say, a latin square lay-out. Shell Company's Research Station, Modesto, California.

Unfortunately, in my hurried trip, Dr. Marshall was away from Summerland when I was there, but in a letter he informed me that an experimental sprayer conforming to the above principles had been constructed, and had been up to his expectations. Following its successful trials, two commercial machines have been constructed based on these principles. One of them uses steam to atomize a concentrated spray mixture, while the other uses hydraulic pressure.

The steam machine employs a low-velocity high-volume air blower to disperse the concentrated fog while the hydraulic one uses high-velocity low-volume air projected by an air turbine. Dr. Marshall now favours the first of these, i.e., the low-velocity high-volume commercial model, and was carrying out experiments with it in 1948.

I understand that a paper embodying the results of these trials was presented recently at the Pacific Science Congress in New Zealand in February 1949, but I have not yet seen it. Sometime this year it is anticipated that an article will be published in "Scientific Agriculture." From what I learned generally in the United States, I would say this article is likely to express a view which is acceptable to North American workers in this field.

Spraying from the Air

The aeroplane and helicopter appeal as a means of spraying field crops and orchards with a minimum of labour and a maximum of speed. When flown close to the ground the "slipstream" is in the nature of a blast of air of great volume directed on to the ground and rebounding sufficiently to cover both upper and lower surfaces of plants.

The slipstream atomizes spray material fed into it so well (droplets 150 to 250 μ) that very small quantities of spray per acre, say, up to five gallons, can be distributed uniformly over the area treated. Thus, these machines always use a very small quantity per acre of a concentrated spray mix, usually in an oil rather than a water base, in place of the large volume of dilute spray mix normally applied by ground sprayers.

In this way they can carry sufficient spray for a reasonably large area. Actually, aeroplanes have been used for spraying field crops, like peas, for a considerable time, and probably inspired the development of the "air carrier" type of ground machine.

During my visit to England in 1948, Pest Control Ltd. of Bourne, Cambridge, which company does a great deal of spray contract work using ground machines, inaugurated a service using a single-engined helicopter (Fig. 17). I gathered that they hoped by 1949 to have at least three machines and were working on the development of a three-engine design because a single-engined helicopter crashes immediately in the event of engine failure, though a single-engined aeroplane similarly placed has a chance of gliding safely to the ground.

Contract rates per acre for annual crops varied from A£2/5/0 to A£5/5/0 depending on the material used. The rates for orchard spraying are somewhat higher.

A detailed report on this service was submitted by the Australian Scientific Research Liasion Officer in London to the Commonwealth Scientific and Industrial Research Organization and would be available for perusal.

In the Western Coast States of U.S.A. the helicopter and aeroplane are both in extensive use for orchard work, and seem to be about equally effective. The helicopter has the advantage that the contractor's depot for spray mixing and refilling can be on a quite small field in the heart of the areas being sprayed, (Fig. 18), thus increasing the area covered each day. Aeroplanes need as a

Fig. 18—Helicopter at the contractor's refilling depot during orchard spraying at Wenatchee, Washington State, U.S.A.

runway a considerable length of land sufficiently smooth to permit a motor car to be safely driven at 40 miles an hour. Wheat stubble was suitable. On the other hand, the costs of purchase and maintenance are, I understand, very much higher in the case of the helicopter.

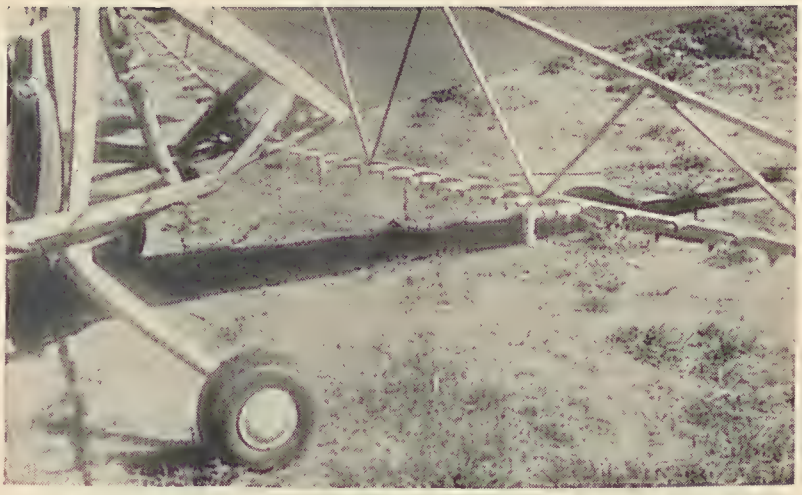


Fig. 19—Spray-boom of the helicopter illustrated in Figure 18. Aeroplanes use similar booms.

From a typical owner-operator of one of the aeroplanes at Hood River, Oregon, I got the following picture from his point of view. The monoplane was capable of carrying 600–700 lb. of spray which is usual. It had cost £250 from war surplus stocks and £1,650 had been invested in ground equipment and special plane equipment. At the optimum flying speed, 80 m.p.h., an area of 140 acres of orchard per day of eight hours was to be expected when flying one row at a time with rows 25 feet apart—an average planting distance for pears, the main crop at Hood River.

The charge for applying any type of spray was £1/17/6 per acre, and, in addition, the grower paid for material. In this case, a fruit-drop spray of naphthalene acetic acid was being applied at the rate of 32 grams per acre on Williams' pears, costing £1/1/3.

On Bosc and Anjou pears and on apples 48 grams of naphthalene acetic acid per acre cost £1/10/0 for material.

All sprays were delivered from the plane's tank to the spray boom at a pressure of 30 lb. per square inch. The boom was fitted with special whirl jets made by Sprayer Systems Co. of San Francisco and Chicago.

Since the cost of orchard spraying depends on the number of days per year on which the machine can be profitably operated, this operator, like others in America and Pest Control Ltd. in England, has to be in a position to cater for a wide range of spray work on a variety of orchard and annual crops.

He contracts for the seeding of rice, and of grass on hill country. He sprays 2,4–D ester on rice and on wheat at stooling time for weed control. In this job he covers up to 700 acres a day flying a swath of 35 feet. The charge for application is 15/9d. and for material 8/3d.—that is, a total cost to the grower of £1/4/0 per acre.

In Victoria it is likely that the comparatively low capital cost of a suitable monoplane, as compared with a helicopter, would make the former the more easily attainable objective.

At Wenatchee in Washington State, the largest apple growing area in U.S.A., about two-thirds of the orchards were being sprayed from the air during my visit with naphthalene acetic acid, as described previously. In view of the fact that practically all of the orchards are equipped with a stationary spray plant with a permanent reticulation of pipes, it was rather surprising to see this extensive development of aerial spraying. Shortage of labour and greater convenience, but not greater effectiveness, was the reason given by growers and departmental officers.

The large trees of Wenatchee receive from 45 to 55 gallons of spray per tree when applied by hand hoses and guns, though experiments show that 25 to 30 gallons are sufficient.

Even on the lowest basis over 1,000 gallons per acre of this fruit-drop spray at a strength of 10 parts per million would be applied as compared with a total of 4 gallons per acre from the aeroplane or helicopter at a strength of 2,400 parts per million. In both methods about 48 grams of naphthalene acetic acid per acre are applied. It is surprising that such a small volume of spray as four gallons can be distributed uniformly enough to give

results satisfactory to growers, and it can be readily understood that research workers consider hand spraying to be really more effective, probably being able to give the same results with half as much active ingredient per acre.

The opinion was expressed to me that the aeroplane would take two applications to do what hand-directed application could do, and this may be true. Nevertheless, in the Wenatchee district, which produces several times as many apples as the total Australian production, and where the orchards are well equipped for ground spraying, most growers use contract aerial application during those parts of the year when labour is insufficient to cope with the work the grower has to do.

Throughout the Western States of America the aeroplane and helicopter are in wide use and though there is still room for research and improvement, the same can be said for all forms of spray application at the present time.

Cow Pox

Cow pox is a contagious disease of cattle, but can also affect sheep, goats, horses, and human beings. A virus is responsible, and this is usually transmitted by actual contact with the skin through small abrasions.

Following infection there is a rise in temperature, a slight fall in milk production, and in four to seven days, a pustular eruption on teats and udder. Young dairy cows are the most susceptible.

Small reddened inflamed areas which become nodular appear, increase in size, and form blisters containing clear fluid. These blisters are sometimes $\frac{1}{2}$ inch in diameter, and depressed in the centre. About ten days after infection there is typical pustule with a broad reddened base and a dark-coloured scab, which, during milking, often becomes dislodged, leaving a tender sore. If left untouched, the scab eventually falls off and a white scar remains.

The duration of the pustular condition is about twenty days, but more pustules may develop by re-infection, and an outbreak may thus last several months. The teats are painful to touch and the cow resents handling, which may interfere with the milk yield. Hence, she requires gentle handling or she may become difficult to manage even after the disease has been cured. If a milk syphon is used to withdraw milk from a painful teat, it must be well sterilized otherwise infection may be taken into the quarter, resulting in mastitis. Mastitis may also occur if calves are allowed to suck affected cows, causing the pustules to run together to form large infected areas.

Treat by keeping the pustules soft with applications of a mild ointment such as zinc oxide ointment or boracic ointment. Vaccination similar to the human small-pox method may be adopted as a preventive measure.

Infected cattle should be isolated or at least milked after the normal cows have been dealt with. The udders and hands should be well washed with disinfectant after each cow to prevent infection being carried to the next cow, and also to protect the milker in case there may be small wounds on the hands through which infection may enter.

[By H. Tucker, B.V.Sc., Veterinary Officer.]

IN THE ORCHARD

By G. W. Gayford, B.Agr.Sc., Senior Horticultural Instructor

PLANTING STRAWBERRIES

New strawberry beds may be set out in August. The usual distances for the planting of runners is 12 inches apart in rows 2 feet 6 inches to 3 feet apart. Only healthy runners should be planted. Popular varieties grown by commercial berry growers are Melba, Silvan Beauty, Telopea, Tardive de Leopold and Wilson's Pride. Melba is a most attractive berry but because of severe virus infection this variety is not planted as widely as some of the others. Several varieties should be planted in adjacent rows to provide for cross pollination.

A strawberry plantation at Sylvan, Victoria.

SPRAYING IN SPRING

Reports from all fruitgrowing districts indicate that a fairly heavy blossoming of all deciduous fruit varieties may be expected during the next month or so. With such a promise of good crops, orchardists will need to protect their trees as far as possible from the attacks of the insidious pests and disease spores which commence activity with the onset of spring warmth.

Last season the fungous diseases brown rot in stone fruit and black spot of apples caused fruit growers considerable financial loss. Many orchardists consider that these diseases are included among the inevitable risks of growing fruit, and like frosts, hail, and windstorms, they must be fatalistically accepted. However, once a disease has wrought havoc on a fruit crop there is usually an outcry for more effective spray programmes or fungicides.

As far as fungicides are concerned it is a fact that, at the present time, we haven't anything as new and as spectacular as DDT., HETP. and Gammexane have been in their respective fields as insecticides. But this doesn't mean that we should not make every possible use of existing suitable material such as Bordeaux and lime sulphur. Provided it is possible to cover and keep covered developing flowers and shoots with fungicide during the critical period of fungous activity, it should be possible to obtain very good results.

The fungicide must be strong enough to prevent spores from developing, yet not too strong to cause damage to fruit. Unfortunately for a fruit such as the apricot, the effective period during which it is possible to provide fungicidal protection is reduced to the pre-blossom bud-burst stage because of the susceptibility of this fruit to both copper and sulphur injury. Brown rot in this fruit therefore is rather difficult until suitable alternative fungicides have been discovered.

Full strength Bordeaux 6 : 4 : 40 at bud-burst should be regarded as a foundation spray to be applied to apples and pears and stone fruits for the protection of the unfolding leaves and flower buds. This spray will assist in the control of black spot in apples and pears and diseases of stone fruit such as brown rot, peach-leaf curl, "shot hole" and peach or prune rust. For black spot on apples and pears, further sprays are required to keep the rapidly-growing flowers

covered. A leaflet on this subject may be obtained free of charge on application to the Stores Branch, Department of Agriculture, Melbourne, C.2. This sets out in detail the best available schedule for each particular variety and if properly followed there should not be much trouble later with summer spot.

PRUNING AND PLANTING CITRUS TREES

September may be regarded as the best month for pruning and planting citrus trees. Because of the stimulus to new growth, pruning should be delayed until the spring so that the new shoots will be less liable to suffer from frost injury. A general thinning out of growth on mature trees stimulates development of new fruit-producing shoots and by the removal of diseased or dead wood, the skin quality of market lemons is improved by reducing the possibility of rind marking. An occasional opening up of the trees also permits a more thorough coverage of spray materials for scale and disease control.

When planting nursery trees, a hole should be dug wide enough to enable the roots to be well spread out and deep enough so that the tree can be set in the ground no deeper than when it was growing in the nursery. In fact for lemon trees, which are notoriously subject to collar rot and root rot if planted deeply, it is a good idea to plant them on a slight mound so that in later cultivation up to the tree the bud union will not be covered with soil.

Immediately after planting it is advisable to cut back the top growth of the young trees and remove any shoots, particularly vertical growths, which are likely to develop into badly placed limbs.

LIVE STOCK NOTES—*(continued from page 354).*

exposure to temperature lower than these may cause serious losses. If chilling resulted in a hundred per cent. loss everybody would be convinced of the risks involved, but this rarely occurs. When hatched, the chicks are placed in either chick-boxes or intermediate brooders until they are sexed, and if these duties are carried out without delay, no risks are involved. It may be of interest to mention that some strains of chickens appear capable of enduring great hardships without displaying any harmful effects, but other strains are not endowed with such vigor.

When chicks are transferred quickly to boxes, and the flats and lids placed promptly in position, they will be comfortable and safe during the period between removal from incubator, and sexing, provided they are sexed the same day. The temperatures in incubator rooms rarely exceed 70° F., and if chicks are exposed to this temperature for long periods they may suffer harmful effects. To guard against chills, ordinary household heaters should be installed to provide warmth while the chicks are being sexed.

In some large hatcheries the chicks are sexed in air-conditioned brooder rooms where the temperature is 90° F. to 95° F. and losses in these hatcheries are negligible.

The poultry farmer who incubates his own chicks has every opportunity of avoiding losses if he is prepared to adopt reasonable precautions during the transfer of chicks from the incubator to the brooder. Day-old chicks can be safely dispatched over long distances with perfect safety, but buyers should take delivery immediately on arrival, as chicks may receive a check if the chick-boxes are left lying around, particularly in cold weather. Brooders should be heated up in preparation for the chicks and no time should be lost in placing them under the hovers. Woodwool makes an excellent packing for chick-boxes as it remains firm and provides a sound base for the youngsters during transit. It is easily removed and may be burnt when finished with.

Chicks are usually 24 to 48 hours old when delivered and should be given food and water an hour or two after arrival or when they appear to have settled down in the brooders.

Careless handling at either end will result in losses, but given reasonable care they should rear well if they are free from infectious disease.

[M. D. Hall, Poultry Expert.]

THE AUSTRALIAN PLAGUE LOCUST

Aerial Spraying Campaign, 1946

By T. W. Hogan, M.Agr.Sc., Senior Entomologist, Biological Branch

During the months of April and May, 1946, large egg-laying swarms of the Australian Plague Locust (*Chortoicetes terminifera* Walk.) occurred in various parts of the northern Mallee and established numerous egg-beds. The danger of an outbreak in the following spring was clearly indicated, and called for prompt action by the Department. Detailed plans were at once drawn up for an anti-locust campaign, and these plans included provision for large-scale aerial spraying. For this purpose the co-operation of the R.A.A.F. in the supply and operation of aircraft was obtained. Arrangements were also made for the importation of some 20 tons of benzene hexachloride and for the preparation of approximately 130,000 gallons of insecticidal solution.

When the outbreak commenced in the spring, four suitably-equipped Beaufort aircraft were made available by the R.A.A.F. and these planes operated from Mildura, Swan Hill and Tocumwal aerodromes. Practically the whole of the locust-infested area was within 100 miles of these centres, a distance considered by the Air Force to be the maximum safe operating range.

AIRCRAFT

BEAUFORT Mark IX aircraft fitted with spray-bars as described in an earlier paper (Hogan and Slape, 1946) were used throughout the campaign. The spray-load of the plane was increased by isolating the two inner main fuel tanks from the fuel system, and using them to carry spray solution. Each wing tank had a capacity of 194 gallons which, together with the bomb-bay tank of 138 gallons, enabled a total of 526 gallons of spraying solution to be carried. The solution was transferred from the wing tanks to the bomb-bay tanks by fuel booster pumps. The remaining tank capacity for fuel was 182 gallons, giving a maximum flying time of two hours.

INSECTICIDAL SOLUTION

A 4 per cent. solution of benzene hexachloride (Gammexane) in diesel fuel oil, was used throughout the campaign. The benzene hexachloride contained 13 per cent. of the gamma isomer.

Arrangements were made with the Munitions Department, for the mixing of the spray at Maribyrnong. This was carried out in a vat of 2,000 gallons capacity, fitted with a stirrer and heated by an oil furnace. After mixing, the spray was put into 44-gallon drums and railed to country centres. It was then pumped into tankers, from which it could be quickly loaded into the planes.

ORGANIZATION

The existence of an organization for the collection of information, and also to determine the reliability of the information forwarded by growers, was found essential. In this regard the officers of the Department of Lands and Survey of Victoria, played a major part. These officers and those of the Department of Agriculture acted as information centres in their districts, receiving information from farmers, checking reports, and forwarding these to the Biologist, Plant Research Laboratories, Burnley or to the Liaison Officer working with the R.A.A.F.

Assessment of the relative needs for aerial spraying as between the various districts was made from the Plant Research Laboratories, Burnley, based on reports from each district and surveys by entomologists.

When, from reports received, the need for aerial spraying seemed to be indicated, a Survey Officer from the Department of Agriculture visited the infested area to decide whether the aerial spraying should be used.

Filling drums with insecticidal solution at the explosives factory, Maribyrnong, ready for dispatch to the plague areas.

Each farmer was informed when the operation would be carried out, and asked to mark out the approximate position of the infestation just prior to the arrival of the ground team. The latter consisted of two officers of the Department of Agriculture, with a utility truck, and a wireless van and operator provided by the R.A.A.F. Only two of these parties were in action at any one time.

TYPE OF COUNTRY CONCERNED

Most of north-western Victoria comprises "mallee" country, which is either flat or broken by low undulating sand hills. The natural vegetation is mainly eucalyptus scrub which is seldom more than 30 feet in height. The average rainfall is about 10 inches per annum, only a small proportion of which occurs in the summer. Wheat growing combined with sheep raising is the chief agricultural industry.

Along the River Murray the topography, natural vegetation and agricultural pursuits all differ from the above, but this represents only a fraction of the total area. On the other hand the presence of valuable irrigated crops in several parts of the Murray valley, such as at Mildura and Swan Hill, complicated the problem of providing protection from locusts.

In general, the topography is suited to low flying operations, and as good weather conditions prevail during the summer, the area can be considered a favourable one for an aerial spraying project.

HOPPER STAGE

In several long-distance traverses made across various parts of this area the proportion of the traverse occupied by "hopper" bands varied from 0 per cent. to 5 per cent. The density of these bands up to about the third instar was of the order of 50 per square foot.

After hatching and the occurrence of "hoppers" in small patches, large bands were formed which travelled considerable distances over the countryside, but in no one general direction. Bands varied in size, and many of those which invaded the crop were several hundred acres in extent. The writer observed one swarm a mile wide crossing a road in the southern Mallee.

Aerial spraying was employed against hopper bands only if they occupied an area of more than 20 acres, other methods being used against smaller bands. The prevalence of large bands is shown by the fact that a total of 7,000 acres of this type of infestation was treated from aircraft. Most of these bands were in young wheat crops.

ADULT STAGE

Winged locusts appeared in large numbers in the first half of November, and a large proportion were present in comparatively loose swarms, the density of which was approximately one or two per square foot. Other swarms were of the order of twenty or more per square foot.

It seems probable that the huge numbers of "hoppers" destroyed by spraying may account for the relatively low density of most of the winged swarms. Several very dense swarms crossed the river into the north east of Victoria in mid-December. Some spraying was carried out against them, but as they continued their migration eastward beyond the Victorian agricultural districts, spraying was discontinued. These were egg-laying swarms, and established egg-beds in some parts of the north-east, but conditions were apparently unsuitable for development as no hatchings were reported.

At an earlier stage small swarms crossed into Victoria from New South Wales near Swan Hill, but in general, migration into the State was not an important factor, as drought conditions in New South Wales had destroyed the plague numbers developing there.

Beaufort aircraft in action against locust swarms in the Victorian Mallee.

[The Herald—The Sun photo

SPRAYING PROCEDURE

It was customary for the ground team to arrive in the area about an hour before the plane. This gave them time to acquaint themselves with the lay-out of the country, and distribution of the swarm or swarms. After deciding on a suitable subdivision of the area, smoke generators would be set out to mark the first run. In general, flights were made at right angles to the wind direction and the operators would commence on the down-wind side and work up-wind to avoid moving into the sprayed area. Swathes of approximately 70 yards were used.

As the plane approached, the smoke generators were lit, and wireless contact was made. After a preliminary discussion with the pilot on strength of wind, extent of infestation, &c., the first run would be made along the line indicated by the smoke generators, spraying commencing at the first and finishing at the second.

In placing the first generator, allowance was made for the travel of the plane between the time of opening the tank valve by the navigator, and the emergence of the spray from the spray bars. It was found that runs of more than half a mile in length were undesirable as the markers were unable to communicate with each other readily.

In open country smoke could be dispensed with, and signalmen with flags were found sufficient; but with scrub present or in broken country, smoke generators were essential. To avoid risk of fire they were carried in special containers with spark arresters.

The procedure was therefore simply to make a series of runs, the smoke generators being moved not more than 70 yards up-wind for each run, until the infested area was completely sprayed or the plane emptied of solution.

DOSAGE RATE

A total spraying time of 116 seconds was required to empty the spray tanks. Travelling at 140 knots per hour, the plane would cover 9,140 yards during this time and,

Placing smoke generators along the course the plane is to fly.

with a swathe 70 yards wide, would cover 129 acres. In this way a dosage of approximately 4 gallons per acre was obtained. With a higher speed, as occasionally happened, the dosage would be reduced.

If a particular area was completed without emptying the spray tanks, the pilots found it a simple matter to follow the wireless van to a new patch, and if necessary, a series of small infestations could be treated by the one plane.

FURTHER TREATMENTS

Directions as to further requirements, location of the next area to be treated, and other details were given to the pilot by wireless before he left the aerodrome. In the event of a change of plan when working near a drome, direct contact could be made by wireless, or by telephone.

For the success of the operation, it was essential for the air crew to fully understand the ground control system, and the difficulties involved, and similarly, for the ground crew to understand the difficulties of the pilot. As an aid to this, it is advisable for each air crew to spend several days with the ground crew, and the ground crew to make an initial flight in the aircraft.

DAILY OUTPUT

After some experience, ground and air crew become very expert and even without the aid of wireless or smoke generators, could carry out an operation effectively. Under average conditions each ground crew could cover 500 acres a day without difficulty.

OUTLINE OF THE CAMPAIGN

First hatchings of the locusts were reported from the northern Mallee in early September and spraying was commenced on October 16th, by which time the largest of the hoppers, about ½-inch long, were congregated in large bands and were considered suitable for attack by this method. Reports of swarms were so numerous at this time that it was only possible to spray where crops were actually invaded and serious damage was likely.

After the most urgent demands had been met, it was possible to concentrate on one district at a time and endeavour to wipe out all major infestations within that district.

The aerial spraying campaign commenced in the Carwarp district, and proceeded from there to Nangiloc and Redcliffs and along the Redcliffs-Werrimull railway line. Early in November, a threat of considerable damage to irrigated and other crops arose at Robinvale, and every available plane load was sent to this area from November 7th to November 17th. By this time, most of the locusts were in the adult stage, and it was observed that, despite the fact that only portion of the district was treated (between four and five thousand acres), the locusts rapidly disappeared from the whole district. In view of the success attained by concentrating treatment in one district, the same method of attack was adopted in the Millewa area near Werrimull, and here again the same phenomenon was observed. No general migration from the area was noted, but reports of swarms flying out of the area were often received. These did not migrate in one general direction as is usually the case.

From 15th November to 17th December operations took place in the Swan Hill district, as well as the Millewa. Early in December flying swarms came into Victoria from New South Wales, and were sprayed at

Gonn's Crossing, and opposite Swan Hill itself. These swarms were effectively dispersed, but no estimate of the mortality was possible.

The final operation was in north-eastern Victoria, where, on December 15th, large swarms crossed the river into Victoria at Yarrawonga, and, later, swarms were reported at Rutherglen. Planes were sent to Tocumwal on 17th December, 1947, and spraying took place over the next two days. Practically all the spraying in this area was against dense, "rolling" swarms.

Loading one of the locust-spraying aircraft with insecticidal solution at Mildura aerodrome. *[The Herald—The Sun photo*

Throughout the campaign the mortalities were not as high as in the original test where the 5 per cent. B.H.C. mixture was used. Under satisfactory spraying conditions, however, it was considered that mortalities of the order of 90 per cent. were obtained.

TOTAL OUTPUT

In all, about 30,000 acres of grassland and crops were sprayed with a total of spray solution of approximately 120,000 gallons. The quantities sprayed in different districts are set out in Table 1.

TABLE 1.—QUANTITIES OF SPRAY USED IN EACH DISTRICT.

District.	Volume of Spray.
	gallons
Millewa	74,000
Robinvale	17,000
Swan Hill—Echuca	20,000
Cobram—Rutherglen	4,500
Miscellaneous	5,000
Total ..	120,500

Directing spraying operations from R.A.A.F. truck. *[The Herald—The Sun photo*

Of the total amount, approximately 28,000 gallons were sprayed for the destruction of the locust in the hopper stage, and 92,000 gallons for the adult stage.

FACTORS INFLUENCING EFFECTIVENESS OF SPRAY

Stage of the Insect

The mortality obtained by spraying hoppers was not as high as with the winged locusts. The main reason for this was probably that the distance apart of the larger-sized droplets in the spray was greater than the size of the small insect, thereby leading to considerable variation in the dosage received by individual insects,

some being under-dosed, others over-dosed. With the larger-sized winged locust this variation was reduced as each one tended to pick up the full range of different-sized droplets.

Vegetation

Where the insects were present in heavy growth they were protected to some extent from the spray, and a lower mortality occurred. In young erect cereal crops, mortality was not affected, but in heavy mature crops with weeds present, or where lodging had occurred, unsatisfactory results were sometimes obtained. Results were poor wherever dense foliage gave cover to the insects.

Wind

Satisfactory results were obtained at wind velocities up to 10 m.p.h., but at higher velocities the spray was dispersed over too large an area to be really effective. It was on comparatively rare occasions that operations had to be suspended because of high winds.

Height of Aircraft when Spraying

It was found that the pilots tended to fly as low as the topography of the area permitted. This was usually about 25 feet and was quite satisfactory except when wind velocities were very low. Under the latter circumstances, the spray was concentrated in a rather narrow swathe, the far side of the swathe being under-dosed. This may not have been as big a disadvantage as would appear at first sight because an improved residual action of the spray on the over-sprayed areas may have resulted.

Temperature

Spraying operations were carried out throughout the day, and if there was any difference in percentage mortality due to temperature, it was not sufficient to be apparent without critical counts. (Note :— In spraying for mosquitoes in the tropics it is customary to spray in the early morning to avoid upward air convection currents set up during the heat of the day.)

Accuracy of Application

Accuracy of application is governed by strength and the variability of winds and skill of the operators. Although strong winds are common in north-eastern Victoria during summer, they are not highly variable.

The only occasions on which the accuracy of application is likely to influence effectiveness is in laying down the first swathe. If the plane is run too close to the swarm the spray may be carried beyond the outside edge, which therefore would remain untreated. A variable wind could also have the same effect.

In practice, therefore, the first swathe was laid down outside the edge of the swarm even though it involved a slight wastage.

Toxicity of Sprayed Pasture to Animals

Stock will not readily feed on freshly sprayed pasture, but when confined on to such pasture with no alternative feedstuffs, will eat it without ill effect. In a test conducted with dairy cows the milk from cows grazed in this way was not tainted by the Gammexane ingested.

Effect of the Spray on Crops

The diesel oil fuel used in the insecticidal solution was not phytotoxic to cereals at the dosage used, although an oily film could be seen on the plants, causing treated sections of a crop to present a different appearance from the air. Grasslands were similarly free from damage.

On the other hand, vegetables and vines were spotted by the heavier drops of spray and it therefore became customary to spray " barrier " areas around such crops to prevent invasion rather than to spray the crops themselves. In crops already invaded Gammexane water emulsion was supplied to farmers for application with hand-pumps.

Effect on Bees

No direct test was carried out to determine the effect of aerial spraying on bees, but the precaution was taken of notifying the Apiarists' Association whenever a particular district was to be sprayed. In at least one instance this organization issued a radio warning to growers in one district to keep bees under cover on specified days.

No complaints of mortality of bees in any of the sprayed districts were received at any stage of the campaign.

Cost

As the aircraft were supplied and operated by the R.A.A.F. free of charge, the exact cost of spraying is unknown. At 4 gallons per acre the cost of the insecticidal solution was 10s. per acre. For an operation of this

nature the cost of the aircraft varies according to continuity of the operation. In this instance the aircraft were constantly employed and were not held up by bad weather, accidents, or other untoward events. In these circumstances an operational cost of £30 per hour would be a reasonable one, giving a cost of 4s. 6d. per acre for the plane, and transport of materials to the aerodrome.

As the R.A.A.F. staff involved would have been employed in any case it is apparent that the actual extra cost involved to the Air Force in this project would be only the running costs of aircraft without staff, which would amount to considerably less than £30 per hour.

The chief difficulty in this class of work is its intermittent nature. Outbreaks occur only in one part of the year and not every year. For a private firm to maintain planes for this work only would be impracticable, therefore it must be a part-time job for an organization which uses its planes for some other purpose. As passenger lines seldom have planes which could be diverted for any long period it would appear that the R.A.A.F. could provide the service at a lower actual cost than any other organization.

EFFECTIVENESS OF CAMPAIGN

As the result of the destruction, by aerial spraying, of locust swarms aggregating 30,000 acres, and by the baiting method of 7,000 acres, damage to crops in the Mallee area was kept to a minimum. Moreover the rich Wimmera district to the south, where wheat crops to the value of some £5,000,000 were growing, did not suffer from any invasion of swarms from the northern areas such as had occurred after previous outbreaks, and this is attributed to the thinning out of the swarms to a point where relatively few remained at a population density sufficient to induce migration.

CONCLUSIONS

As far as can be ascertained this is the first occasion on which aerial spraying had been used as the principal means of combating a locust plague. The success of this first large-scale application has shown that, under the conditions existing in Victoria, aerial spraying is a highly effective method and that there should be scope for its application in other areas subject to locust outbreaks.

In this campaign it was originally planned to use aerial spraying as an auxiliary to baiting. Actually the ease of application, speed and efficiency possible with the method resulted in it becoming the principal means of control from the time it was first used.

In view of its effectiveness against "hopper" bands, it is realised now that it would have been an advantage to commence this method much earlier rather than wait until the hoppers had reached the "baiting" stage. Before this operation it was believed by the author that the method would be inapplicable prior to the formation of migratory bands, but actually it was found that the great density of hoppers occurring irregularly, more than compensated for the wastage due to treatment of uninfested areas between such patches.

SUMMARY

An account is given of what is believed to be the first occasion on which aerial spraying has been used as the principal method of controlling a locust plague.

The operations were carried out during the spring of 1946, when a serious locust outbreak in northern Victoria threatened the destruction of crops in that area.

A description is given of the aerial spraying methods, material, organization, and spraying procedure used in the 1946 locust campaign in Victoria. Comments are given on factors influencing the effectiveness of the spraying, and the net effect of the spraying and baiting treatments.

Four aircraft were operated by the R.A.A.F. throughout the campaign and a total area of 30,000 acres occupied by locust swarms were sprayed.

This measure, in combination with baiting, was effective in keeping damage within northern Victoria to a minimum and in preventing any general migration of swarms to the southern districts of Victoria.

LITERATURE CITED

Hogan, T. W. and Slape, H. W.—*Jnl. Agr. Vic.* 1946, pp. 553–558.

CERTIFIED PULLORUM-TESTED FLOCKS (POULTRY)

A certified Pullorum-Tested Flock is one in which all stock over six months of age have given a negative reaction to the agglutination test for Pullorum Disease, and in which all such stock are kept under rigid conditions of isolation approved by the Chief Veterinary Inspector.

The undermentioned flocks have been certified by the Department of Agriculture, and will remain so for the current calendar year, or until such time as the Chief Veterinary Inspector determines.

Application forms are obtainable from the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

Particulars of breeds of birds tested are as shown hereunder:—

A. Australorp; B. White Leghorn; C. Rhode Island Red; D. Sussex; E. Langshan; F. Brown Leghorn; G. Buff Orphington; H. Black Leghorn; I. Minorca; J. Ancona; K. Legbar; L. Indian Game.

Owner.	Breed.	Number of Birds.
Agricultural College, Dookie	A, B	1,726
Anderson, G. M., Greensborough-road, Macleod	A	1,488
Anguey, H., 138 Hargreaves-street, Castlemaine	A, B	725
Arnold, J. B., Terrara-road, Vermont	A	810
Ashgrove Poultry Farm, Cockatoo	A, B, C, D	3,035
Baker, J., Greensborough	A	1,077
Barastoc Experimental Farm (G. Lee Manager), Croydon	A. B, C	716
Bayfield, A. E., Seven Acres Poultry Farm, Springvale	B, C	1,374
Bingley, A., 333 Highbury-road, Burwood	A, B	2,108
Bird, F. V., Middlebro-road, Box Hill	A	323
Bishop, Mrs. P. M., Springvale-road, Springvale	A, B, C,	1,810
Boyce, A. D., Springvale-road, Forest Hill	B	1,097
Bray, J., 18 Hotham-street, Warrnambool	B	140
Brumby, W. E., Ellendale-road, Noble Park	A, C	438
Burney and Pound, North-road, Langwarrin	A, B	1,731
Cannings, P. G. A., Shepparton East	B	3,932
Carlella Poultry Farm (J. W. Stoneman), Campbell's-road, Briar Hill	C, F	272
Cashin's Poultry Farm, 2 Dawson-street, Stawell	A, B	2,528
Chalmers, H. L., 9 Lefevre-street, Spotswood	B, F, K	582
Chamberlain, L., Nathalia	A, B	1,984
Chapman, Mrs. E., Youanmite	A, C	282
Christie, R. R., and Son, Tucker-road, Bentleigh	A, B, C	879
Cole, R., Mooroopna	B, C	416
Collins, A. J., Emerald	A, C	354
Colquhoun, Dr. W. L., "Aringa," Ringwood	A, B	195
Cook and McKnight, Croydon	A	1,568
Corbett Bros., Torbay-street, Macleod	A	2,318
Coupar. J. E., Box 18, Nathalia	A, B, C	388
Davidson and O'Keefe Hatchery (Mrs. M. H. Turner, Prop.), 22 Sherwood-avenue, Ringwood	A, B	75
Davies, L. F., Westall-road, Springvale	A, C	1,368
Davis, C., Tarilta	A, B	866
Davis N. W., Mickleham, via Broadmeadows	A, B	3,089
Dawson, R. G., Maldon-road, Castlemaine	B	1,285
Day, L., Box 39, Kyabram	A, B, C	1,778
Deakin, J., 21 Troy-avenue, Bonbeach	A, B	301
Dugan Bros., Broadmeadows	B	8,864
Ellen J. Rossmoyne Pig and Poultry Farm, Avoca	A, B	1,919
Emmott, J. T., Verdon-street, Inglewood	A, B	293
Farmer, C. R., Whitehorse-road, Ringwood	A, B, C, D, K	2,260
Fellows, J., Yan Yean-road, Plenty	A, B, C	859
Fitchett, C. W., Spring Vale-road, Tally Ho	A, B	1,484
Fletcher, J. H., "Homeleigh," Tallygaroopna	B	1,621
Ford, J. V., 11 Barkers-avenue, Shepparton	A, B, C	1,026
Fraser, R. A., and Son, Colchester-road, Kilsyth	A, B, C	947
Frye, I. H., Grimshaw-street, Watsonia	A, B	1,937
Gedye Bros., Railway-road, Blackburn	A, B	3,775
Giarrusso, G., Lower Dandenong-road, Braeside	B, C	462
Gibbs, A. E., Stanhope	A, B	3,734
Gibbs, J. L., Lower Plenty	A, B	983
Grenville Poultry Farm, Springvale-road, Springvale	A, B, C	3,666
Guy, J., "Murlea," Murgheboluc	A, B, C	670
Gwyther, R. P., "Woorrayl," Highton	A, B	1,144
Hamblin, N. A., Sunny Hill Poultry Farm, Toolleen	A, B	3,423
Hanson, S., Kilmore	A	237
Harrington, G. W., Springvale-road, Tally Ho	B	1,836
Harrington, W. H., Woodward-street, Golden Square	A	1,597
Harrison, A., Shenfield-street, Cobden	A, B, C, D	300
Hayes Bros., Mount Dandenong-road, Montrose	A, B	3,564
Henderson, C. W., Shepparton	A	395
Hewett, A. T., Central-avenue, Croydon	A, B	863
Hopkins, C. A., and Sons, Success Poultry Farm, Knight-street, Shepparton	A, B	1,656
Hunt, R. R., 365 Highbury-road, Burwood	A, B	1,298
Hurst, B. H. G. (Mrs.), New-street, Eltham	B	2,768
Ikin, E. J., 44 McKay-street, Seddon	C	86
Inglis, W. J., Cobham-road, Mitcham	A, B	530
Jackson, Miss E. M., 4 Monash-street, Box Hill	B	48
James, D. E. and K. D., Spring Gully, via Bendigo	A, B, C	1,127
Johnson, A. S., Burwood-road, Ferntree Gully	A, B, C	2,282
Kay, V., 12 Wellington-street, Blackburn	A, B	2,634
Kenneally, W. R., Hallam-road, Hampton Park	A, B	1,503
Kennedy, F. Ferntree Gully-road Waverley	A, B, C	677
Kerr J. J., Clarke-road, Springvale	A, B	2,052
Kostos Bros., Oakleigh	A, B, C	473
Lang, J. L., 46 Dundas-street, Thornbury	E	104
Lattimore, A. G., Kilsyth	A, B, C	817
Lintermans, W. A. J., Major-road, Lysterfield	C	1,160
Longerenong Agricultural College, Dooen	A, B	720
Lonie, R. A., 1 Chanak-street, East Malvern	A, B, C	37
Lucas and de Molnar, 4 Downong-street, Blackburn	A, B	1,639
Magnusson, L., Nathalia	B	936
Maher, A. E., Wal Wal	A, B	765
Major, C. D., Simpsons-road, Eaglehawk	A, B	2,000
Marshman, A. R., Archie's Creek	A, B, C	767
McCabe, R., Gladstone-road, Dandenong	A, B, D	2,079
McCann and Sons, Crowlands-road, Stawell	B	4,198
McEwan, A. W. H., Whitehorse-road, Ringwood	A, B, K	157
McLauchlan, D. F, Rossiter-road, Koo-wee-rup	A, B	2,500
McTighe, C. H., Nar-Nar-Goon	A	571
McVay, A., Kernot-street, West Spotswood	A. B	2,506
Mead, J. L., 28 Golf Links-avenue, Oakleigh	A, B	254
Mills, J. J., Kelvinside-road Noble Park	C	267
Mold Bros., Banbury Park Poultry Farm, Old Narre Warren-road, Emerald	A, B	1,141
Molsons White Leghorn Stud (G. Durkin, Man), 188 Surrey-road, Blackburn	B	1,311
Moran, S. G., Glenburnie-road, Mitcham	A, B	732
Moroney, J. B., Kangaroo Flat	B	1,150
Mumford, L. J., Healesville	A	400
Neal, J. H., 18 Watt-street, Spotswood	L	22
Niewand, F. J., "Kalang," Lubeck	A, B, C	1,275
O'Brien, R. J., Watson-road, Glen Waverley	A, C	694
Paton, W. S., Glenburnie-road, Mitcham	A, B	477
Poulton, A. W., Vickers-street, Sebastopol	A, B, C	2,321
Rae, J., Albert-street, Sebastopol	B, C	1,889

(continued on page 378.)

POULTRY FEEDING TESTS

State Research Farm, Werribee, 1948-49

By M. D. Hall, Poultry Expert, and A. G. Clark, Poultry Foreman

EXTENDING over a period of twelve months from 1st April, 1948 to 31st March, 1949, poultry feeding tests were conducted at the State Research Farm, Werribee, to test the comparative values of average quality wheat and shrivelled wheat as a grain ration for laying fowls, and the economic value of feeding an all-mash ration without grain.

For the purpose, 250 Australorp and 250 White Leghorn pullets, hatched in August and September, 1947, were used and divided into pens each containing 50 birds. The birds were intensively housed in a laying shed 110 feet long and 20 feet deep, divided into 10 pens each 11 feet by 20 feet providing a little over four square feet of floor space per bird.

THE RATIONS

In the course of the test, the following rations were fed :—

Pens No. 1 (Australorp) and 10 (White Leghorn)

Dry mash (30 lb. bran, 60 lb. pollard, 10lb. meatmeal, 1 lb. salt) always available in hoppers ; greenfeed ; no grain.

Pens No. 2 (Australorp) and 9 (White Leghorn)

Dry mash (30 lb. bran, 65 lb. pollard, 5lb. meatmeal, 1 lb. salt) always available in hoppers ; greenfeed ; no grain.

Pens No. 3 (Australorp) and 8 (White Leghorn)

Control pens ; dry mash (30 lb. bran, 60 lb. pollard, 10 lb. meatmeal, 1 lb. salt) always available in hoppers ; mixed grain (4 parts wheat, 1 part oats, 1 part barley) fed in litter; greenfeed.

Pens No. 4 (Australorp) and 7 (White Leghorn)

Dry mash (30 lb. bran, 60 lb. pollard, 10 lb. meatmeal, 1 lb. salt) always available in hoppers ; free choice average quality wheat in hoppers ; greenfeed.

Pens No. 5 (Australorp) and 6 (White Leghorn)

Dry mash (30 lb. bran, 60 lb. pollard, 10 lb. meatmeal, 1 lb. salt), always available in hoppers ; free choice shrivelled wheat in hoppers ; greenfeed.

Shell grit was available in all pens.

As in previous tests, the cost of food was arrived at by taking the average wholesale prices published in the daily press during the year. Delivery charges were not added. The eggs laid were valued at the gross wholesale hen-egg price without deducting any marketing or grading charges. These charges would probably average approximately 6½d. per dozen, which with an average production of 15 dozen eggs would amount to 8/1½d. per bird per year.

The return over food costs is considerably higher than that obtained on commercial poultry farms, due to the birds being tested only during the productive period. The actual purpose of the tests is to try and find the most suitable foods for economic egg production by using various combinations and qualities of foodstuffs.

The cost of rearing the birds was not taken into account, as all those used in the tests were reared on free range and kept there until they were drafted into pens just prior to the commencement of the test. Losses of birds prior to the test through accident and various other causes make it difficult to assess the exact amount expended in rearing the test birds.

The tests were conducted under rather favorable conditions. The mortality rate, 7·2 per cent., was evenly distributed throughout the pens.

CONCLUSIONS

The tests have shown that average quality wheat is superior to shrivelled wheat as a poultry foodstuff.

The results obtained in Pens Nos. 4, 5, 6 and 7 indicate quite clearly that it is more economical to feed average quality wheat,

as the amount of food consumed is lower and egg production higher than in the shrivelled wheat pens.

While a variety of foodstuffs is considered to be highly beneficial to poultry the theory was not verified in these tests, as the greatest number of eggs was laid by the birds in Pen No. 4, fed dry mash, average quality wheat and greenfeed. The birds in Pen No. 7 were fed a similar ration and results did not entirely support this theory.

A wide disparity in egg production figures was shown in two control Pens Nos. 3 and 8. Here, two groups of 50 birds fed a similar ration, with all factors in regard to housing and management equal, went on to lay an average of 194·9 and 176·7 eggs respectively. This indicates the variation in quality between the groups of birds in the different pens. Another typical example is shown in Pens Nos. 1 and 10.

The food consumption in Pens Nos. 4 and 7, where dry mash and average quality wheat were fed, was low and egg production good. The inference is that mash, fed in conjunction with average quality wheat, encourages maximum production for the minimum amount of food consumed.

The results obtained by feeding mash only, indicate that the system is fairly sound and no additional eggs are produced by feeding excessive quantities of meatmeal.

Detailed results of the tests are set out in Table 29 on the following page.

CERTIFIED PULLORUM-TESTED FLOCKS (POULTRY)—*(continued from page 376).*

Owner.	Breed.	Number of Birds.
Ranleigh Poultry Farm (D. H. Tokimosa, Prop.), Dingley	A, B	743
Ridge and Son, 42 Myrtle-grove, Blackburn	A, B, C	3,045
Robinson, W., 11 Olive-street, Hampton ..	B, C	1,029
Rose, H., Yarrambat	B	583
Rowe, Mrs. L. M., "The Wattles," Wal Wal	A, B	319
Salmond, J. B., Deer Park	H	246
San Miguel, M. H. (Mrs.), Woodhouse-grove, Box Hill	A, B	1,896
Scales, J., West Wattle Tree-road, Boronia..	A	1,492
Settle, J. H., Stanhope	A, C	2,491
Simpson, G. D., May-road, Glen Waverley ..	B	2,928
Smith, A. W. and M. P., Terang Poultry Farm, Terang	B	969
Smith, F., Lenham Poultry Farm, Terang	A, B	3,307
Smith, H. A., Marong-road, Maiden Gully ..	A, B, C	1,196
Snodgrass, R., Pakenham East	B	1,352
Stant, W. J. and F. E., Westall-road, Spring Vale	A, B, C	2,957
State Research Farm, Werribee	A, B	2,062
Stewart, J., Maldon-road, Castlemaine ..	A, B	565
Stewart, P. D., Bayswater-road, Croydon ..	A, B	1,028
Streeter, H. A., Avoca	B	508
Swift, D. A., Kangaroo Flat	A, B	2,313
Taylor, H. L., 180 Surrey-road, Blackburn..	A, B	1,389
Taylor, H. R., Rosebank Poultry Farm, Reservoir	A, B, C	5,357
Taylor, R. H., 132 Rathgowan-road, Reservoir	A, B, C	3,730
Teitz, G., 21 Kingsley-crescent, Mont Albert	B	736
Thomson, S. R., Bacchus Marsh-road, Corio	A, B, C	1,513
Voigt, A. H., Sunnyside Poultry Farm, Follett-road, Cheltenham	A, B	1,412
Walton, F. R., Woodvale-road, Boronia ..	A, C	707
Wandong Poultry Farm (Mrs. M. E. Trembath), Lawn-road, Noble Park	A, B	1,512
Webb, A. E. H., Frankston-road, Cranbourne	A, B	5,653
Welch, T. A., Bayswater-road, Croydon ..	A, B	3,062
Wesley, J. H., "Fairview," Kangaroo Flat	A, B, C	1,210
Williams, V., 91 Tone-road, Wangaratta	A, B	778
Winter, G. A., "Denehurst," Murgheboluc	A, C	355

Test No. 29.—Werribee Feed Tests, 1st April, 1948, to 31st March, 1949 (12 Months).

Pen No.	Fifty Birds per Pen.	System of Feeding.	Number of Birds Died.	Bran.	Pollard.	Meat-meal.	Wheat.	Oats.	Barley.	Total Food Consumed.	Cost of Food.	Eggs Laid.	Value of Eggs.	Return over Food Costs.
				lb.	lb.	lb.	lb.	lb.	lb.	lb.	£ s. d.		£ s. d.	£ s. d.
1	Australorps ..	Dry mash in hopper; meatmeal 10 per cent. green feed; no grain	4	1,443	2,886	481	..	..	..	4,810	21 13 10	8,601	88 16 11	64 3 1
		Average	..	..	..	..	..	..	..	**96·2**	**0 9 10**	**172·0**	**1 15 6**	**1 5 8**
2	Australorps ..	Dry mash in hopper; meatmeal 5 per cent. green feed; no grain	3	1,412	3,058	235	..	..	..	4,705	23 7 5	8,622	89 1 3	65 13 10
		Average	..	..	..	..	..	..	..	**94·1**	**0 9 4**	**172·4**	**1 15 7**	**1 6 3**
3	Australorps ..	Control pen—dry mash in hopper; mixed grain in litter; green feed	4	754	1,507	251	1,579	395	395	4,881	25 13 2	9,749	100 14 1	75 0 11
		Average	..	..	..	..	..	..	..	**97·6**	**0 10 3**	**194·9**	**2 0 3**	**1 10 0**
4	Australorps ..	Dry mash in hopper; free choice average quality wheat in hopper; green feed	4	232	465	78	2,796	..	..	3,571	20 1 4	9,810	101 6 8	81 5 4
		Average	..	..	..	..	..	..	..	**71·4**	**0 8 0**	**196·2**	**2 0 6**	**1 12 6**
5	Australorps ..	Dry mash in hopper; free choice shrivelled wheat in hopper; green feed	2	261	522	87	3,261	..	..	4,131	23 9 0	8,594	88 15 6	65 13 10
		Average	..	..	..	..	..	..	..	**82·6**	**0 9 5**	**171·9**	**1 15 6**	**1 6 3**
6	White Leghorns	Dry mash in hopper; free choice shrivelled wheat in hopper; green feed	4	329	657	109	3,269	..	..	4,364	25 9 1	8,678	89 12 10	64 3 9
		Average	..	..	..	..	..	..	..	**87·3**	**0 10 2**	**173·6**	**1 15 10**	**1 5 8**
7	White Leghorns	Dry mash in hopper; free choice average quality wheat in hopper; green feed	5	286	571	95	2,854	..	..	3,806	23 3 7	9,392	97 0 4	73 16 9
		Average	..	..	..	..	..	..	..	**76·1**	**0 9 3**	**187·8**	**1 18 9**	**1 9 6**
8	White Leghorns	Control pen—dry mash in hopper; mixed grain in litter; green feed	4	738	1,476	246	1,579	395	395	4,829	25 9 11	8,830	91 4 3	65 14 4
		Average	..	..	..	..	..	..	..	**96·6**	**0 10 2**	**176·6**	**1 16 6**	**1 6 3**
9	White Leghorns	Dry mash in hopper; meatmeal 5 per cent. green feed; no grain	3	1,407	3,048	235	..	..	..	4,690	23 13 0	8,733	90 4 3	66 11 3
		Average	..	..	..	..	..	..	..	**93·8**	**0 9 6**	**174·7**	**1 16 1**	**1 6 7**
10	White Leghorns	Dry mash in hopper; meatmeal 10 per cent. green feed; no grain	3	1,546	3,092	516	..	..	..	5,153	26 8 7	9,717	100 7 6	73 18 11
		Average	..	..	..	..	..	..	..	**103·1**	**0 10 7**	**194·3**	**2 0 3**	**1 9 7**
		Total for 500 birds ..	..	..	..	..	..	..	..	44,940	241 8 11	90,726	937 3 7	695 14 8
		Average	..	..	..	..	..	..	..	**89·9**	**0 9 8**	**181·5**	**1 17 6**	**1 7 10**

NOTES.—Average gross price of eggs per doz., 2s. 5¼d.; food cost per doz. eggs, 7¼d.; food consumed per egg laid, 7·9 oz.; food consumed per bird per day, 3·9 oz.; cost of food per bird per week a fraction under 2¼d.

Garden Notes for September

By George Hyam, Horticultural Supervisor

THE FLOWER GARDEN

Carnations from Cuttings or Seed

CARNATIONS are one of the most adaptable of our garden flowers inasmuch as they will flourish in any part of Victoria if given certain soil conditions which are easily provided in most gardens. They produce flowers over a long period, stand up to the hot winds of summer, and do equally well in cooler weather when planted in a sunny position. Carnations can be planted throughout the year, but September is probably the best time to put in rooted plants or seedlings, or to raise seed for later plantings.

Most failures in carnation growing are due to unfavorable soil conditions. Carnations will not tolerate wet or highly acid soils. They must be grown on well-drained soil which is nearly neutral or only slightly alkaline. In most gardens it is best to plant them in a separate bed by themselves rather than in a mixed flower border. The ideal soil is a sandy loam or a heavier soil which has been made friable by the addition of leaf-mould or compost. First, the bed should be limed, then dug over, incorporating the compost throughout a depth of 6 to 8 inches. A dressing of 1 oz. per square yard of 5–1–1 super. ammonia and potash should be raked into the surface layer. The bed must be raised well above adjacent paths or lawns if the drainage is not good. Plants of named varieties can be obtained from plant merchants or specialists. From these, cuttings can be rooted for further plantings.

Cuttings are taken by pulling off side shoots which have not yet flowered with a small heel of bark from the main stem attached. The ends are trimmed off neatly and struck in boxes or beds containing 2 or 3 inches of clean sand, not too coarse. Cuttings can be rooted in the open at any period of the year except December to March. During these months they could be struck under shade. Carnation cuttings respond well to hormone rooting compounds. September is a good month to strike new plants to replace exhausted plants at the end of summer. Although carnations are perennial, they have passed their best in about eighteen months from planting and should be replaced.

Unflowered side shoots of carnations suitable for cuttings. Top—Striking cuttings in pots of washed sand. Lower—Striking in open beds of sandy soil.

Seedling carnations produce a wide variation of colour and form and are usually treated as annuals. Seedlings planted in

September will flower in January and carnation seed sown in September should flower in March.

Seed is best raised in boxes covered with a pane of glass to speed up germination which is rather slow and occasionally erratic, in regard to time. The Malmaison, which is scented, and Giant Chabaud strains produce the best seedling bedding carnations and often produce individual plants well worth perpetuating by cuttings.

Carnation plants should always be provided with supports and not allowed to straggle. They are kept in continuous bloom by promptly cutting off exhausted flower stems near the base. Weak liquid cow-manure applications during the flowering period deepens the colours and produces more flowering stems. There should be little trouble from mildew or rust if drainage is good, but if excessive rain induces these diseases, they can be controlled by spraying with Bordeaux unless their roots are more or less permanently water-logged.

Thrips and aphis are the main insect pests and these can be prevented by the periodical use of sprays with DDT., nicotine or HETP.

Delphiniums from Seed or Seedlings

September is also a good planting time for seedling delphiniums. Those being offered now are usually autumn-sown and have been carefully carried over the winter under protection. Delphinium seed does not germinate well in soil temperatures lower than 55 degress F., nor should seedlings be planted until the soil has reached that temperature which it usually does late in September.

September is a good time to sow delphinium seed in open beds to produce plants which will flower and be equivalent to yearling roots in autumn. September-planted seedlings usually flower in January and if yearling roots are planted out in early September or late August, they should flower in October. There is an erroneous idea abroad that delphiniums, like carnations, need a neutral or slightly-acid soils; actually they do best on soils of relatively high acidity. Delphiniums are gross feeders and the bed should be enriched with decayed or prepared cow or horse manure and after planting, mulched with compost or manure on the surface throughout the summer. Applications of liquid cow manure should be applied when the flower stems appear in spring and autumn and, between times, given at least two side dressings with a complete fertilizer. Lime should be applied only if the soil is known to be very acid, and then only in the form of agricultural ground limestone. An excess of lime is indicated by the leaves becoming mottled and pale with the veins retaining their dark-green colour.

It is best to grow delphiniums from seedlings or, if special colour or form is required, from one-year-old selected crowns or rooted cuttings. Crowns two years' old or more can be divided and replanted but the size of the flower stems and florets from these is seldom good. Cuttings are not difficult to root and shoots which appear from the base of the crown in early spring are used for these. They are struck in clean sand as for carnations but in individual pots which should be under some top shelter.

The spring crop of flowers should be cut off about 8 inches from the crown before they set seed, otherwise the later flowering will suffer. Seed for sowing is best collected from autumn flowers and sown at once. Its life is short and after September it is practically non-germinable.

Other September Work in the Flower Garden

Planting of gladiolii continues through this month. Roses are making new growth which should be watched for the presence of green aphis which will spoil the October flowers if not checked. Spraying with nicotine or HETP will destroy aphis but successive broods may appear later and should be watched for. Liquid manure applied to roses in early September will benefit spring blooms.

September is a good month to apply the selective hormone weed-killers containing 2–4–D on weedy lawns. Sown lawns will benefit by a light top-dressing of a sandy soil early in the month. New buffalo, couch or kikuyu lawns can be planted and should give a good cover by the end of the year.

The first sowing of phlox seed is made in September direct in the beds, and this is best done by sowing two or three seeds to each planting site at a spacing of 4 to 6 inches, thinning out surplus plants when in the two or four-leaved stage. Seedlings of all the late spring flowers can be planted

out but in most districts, summer annuals such as asters, salvias and zinnias should be sown only in seed beds in September or October for planting from November onwards. African and French marigolds seedlings can be planted in September, and these with phlox and the late spring annuals will provide a display until the true summer annuals are ready to flower.

The flowers of annuals now flowering should not be allowed to set seed otherwise their flowering period will be shortened. If spring bulbs are allowed to set seed their vigour next season will be reduced.

THE VEGETABLE GARDEN

Continuous Supplies of Lettuce

It is usually a problem in home gardens how to provide a continuous supply of lettuce for salads during the summer months without undue wastage of plants and garden room. The period from hearting to the appearance of the seed bud is variable according to variety, the time of the year, and seasonal weather. This makes it impossible to lay down any hard and fast rule in regard to any planting scheme, but the problem can be overcome unless the season is abnormal. The proper variety for the season is all-important. Winter and spring lettuce, which are usually the white-seeded varieties, often run to seed without hearting at all if sown in warm weather. Summer varieties, sown in cool weather are very slow in developing and are often attacked by mildew.

A start can be made early in September by planting out seedlings and at the same time, sowing some seeds of New York or Imperial 615 direct in the beds. After thinning, these will mature shortly after the lettuce planted from seedlings. If the thinnings of lettuce sown now are transplanted in late October, they will mature about three weeks after plants left in the beds. After October, lettuce does not transplant readily or if it does become established, it is likely to quickly run to seed. If small sowings of both Iceberg or Imperial 44 lettuce are sown at about three-weekly intervals during October and November, the Iceberg will be ready for use about 3 weeks earlier than the Imperial. From November to February, Imperial 847 and Great Lakes are the best varieties to sow and, as they mature during the hotter months, some can be planted in the open and others where they are in the shade for part of the day. This will mean a difference of about three weeks in the period it takes each sowing to mature. The length of the row should be based on the family needs for about three weeks in each case, allowing about 4 or 5 plants to each yard of row.

Another method of ensuring supplies during the hot weather is to plant some of the more open-hearting varieties such as Continuity, Buttercup or the Butterhead species. These form a loose heart barely distinguishable from the outside leaves and when freshly cut, compare more favorably with close-hearting lettuce that has been picked for some time and purchased in shops.

Individual plants of any lettuce can be forced along more rapidly by weekly waterings with a weak nitrate of soda solution (about ½ oz. to 1 gallon) and withholding it from others. The solution is applied as soon as the centre leaves curl inwards, and is best applied to plants at one end of the row so that it does not diffuse to others it is not intended to force. Such applications can reduce the time taken for normal development to hearting by a fortnight or three weeks, according to outside temperatures and humidity.

Placement of Fertilizers

A good deal of research is being devoted to the question as to the depth and position at which fertilizers should be placed for various commercially-grown vegetable crops to ensure best results and economy in rates of application. The home gardener can apply to advantage the principle of fertilizer placement by "banding" in relation to most garden grown vegetables. Broadly speaking, this is to place the fertilizer in narrow bands 2 inches from each side of the seed row before sowing, and at a depth 2 or 3 inches below the seed. Side dressings are applied to growing plants 3 or 4 inches deep and 4 to 6 inches away from the stems of the plants. The effect is to avoid all danger of fertilizer damage to the germinating seed and to encourage better growth by the mild diffusion of the food elements to young plants. Side dressings of fertilizer can be added as the plants grow. So long as the soil has a reasonably good supply of

Correct placement of fertilizer in relation to potato seed-piece is indicated in this illustration.

organic matter, about half the quantity of fertilizer necessary for broadcast applications will give as good or even better results. "Banding" fertilizers is to be highly recommended for peas, beans and potatoes which are often damaged by being planted in direct contact with fertilizers.

Once garden soil has been provided with a reasonable amount of organic manure throughout the first 6 to 8 inches, fertility can be maintained with smaller quantities by using compost or animal manures as a mulch instead of digging them under, especially during spring and summer. Much of this manure is incorporated in the top-soil by natural action, and any residue is dug into the lower levels after harvesting for the benefit of the next crop. Animal manure can be applied as a mulch to any vegetable and even where it is not desirable to dig in animal manure just before sowing as with root crops. This practice has the additional advantage of helping to conserve moisture and in keeping the surface cooler in summer.

Other September Work in the Vegetable Garden

Beds to be planted with tomatoes, egg plant or capsicums are best prepared as early as possible in September for the usual planting times from October onward. Omit lime for these crops, but dig in a good dressing of organic manure or compost. A week or two before planting out work into the top soil a broadcast dressing of 2 oz. of 5-1-1 complete fertilizer or band each plant with about a teaspoonful of the same fertilizer after planting.

September is too early to make main sowings of beans except in the northern areas, and then only in districts where frosts are unlikely. In coastal areas and low land districts, it is worth risking a small sowing of butter beans which will grow in rather cooler weather than French beans which rarely produce good pods in these areas from crops sown before October. September is a suitable time to sow the main crop of peas in all districts, and the final sowing of broad beans can be made early in the month. Celery seed can be sown now for planting out in thirteen to fifteen weeks' time, but where seedlings are available, home gardeners will find it more convenient to buy the few plants needed. Celery seed should be hot-water treated before sowing, and the seed-bed regularly sprayed with Bordeaux.

The seeds of tomatoes, egg plants, capsicums and vine vegetables of all kinds for transplanting can be sown now in frames, or with some protection against frost or excessive rain on open seed beds.

In view of the prevalence of harlequin and the green vegetable bugs last season, growers should keep a good look out for the first emergence of these pests in late September if the weather is warm. Their juvenile form is much smaller than that of the adult and the colours are dark compared with the bright colours they acquire later. By closely observing from whence they come and then spraying their harbors with double strength DDT the initial broods can be destroyed. This will save much trouble later.

TUBERCLE-FREE HERDS

ACCREDITED TUBERCLE-FREE HERDS

The following herds have been declared free of tuberculosis under the *Accredited Tubercle-free Herd Scheme* conducted by the Department of Agriculture. Under this scheme a tubercle-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests or upon disclosure of infection, three semi-annual, successive, physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

Name.	Address.	Number in Herd.
Aboriginal Station	Lake Tyers	108
Ampt, E. W.	Gymbowen	8
Ballarat Orphanage	Ballarat	151
Banyule Stud Pty. Ltd.	Wangaratta	79
Beggs, A. R.	Beaufort	116
Black, I. S., Estate of	Mount Noorat	65
Bleakley Bros.	Horsham	14
Bott, J.	Yarrawonga	39
Bruhn, C. H. and V. I.	Mirboo North	54
Candler, G. E.	Hamilton	35
Carne, W. J.	Pakenham Upper	30
Carson, M. E.	Irrewillipe East	86
Cason, J. M.	Lima South	63
Clark, P. W., and Son	Whittlesea	95
Clark, W. J.	Monomeith	142
Cowan, G. L. S.	Bacchus Marsh	61
Cox, F. G.	"Birradale," S. Lyndhurst	47
Cribbes, T.	Wangaratta	40
Deering, J. T.	South Wangaratta	79
De La Rue, N. C.	Tomahawk Creek	69
Dookie College (Ayrshires)	Dookie	117
Dookie College (Herefords)	Dookie	38
Drechsler, W. P.	"Berry Bank" Swan Hill	102
Dunmore, T. J.	Melton	23
Eagle, W. H.	Womerah	31
Fixter, A.	Boisdale	26
Foletta, G. G., and Son	Buxton	130
Fraser, S. T.	Tomahawk Creek	52
Geelong Grammar School	Corio	82
Gilbert, J. A. and R. D.	"Brockelbank," Yinnar South	108
Gilmour, D. W. and N. B.	St. Hubert's-lane, Yering	102
Gleeson, P. J., and Son	Tynong	216
Goddard, James H. & Sons	Cora Lynn	104
Gorman, A. W.	"Cathcart," Alexandra	78
Griffiths, J. G.	Benalla	121
Gross, Mrs. G. F.	Horsham	33
Hamilton, A.	Flinders	104
Hartley, C. H.	Dandenong	117
Hartwick, J. P.	Hamilton	26
Haywood, A. R.	Mordialloc	184
Hicks, L. J. & Sons	Echuca	100
Howell, G. G.	Wollert	130
Howlett, E. and G.	Lang Lang	84
Ivone, M., and Sons	Ovens	103
Jackson, H.	Lockington	81
Johnson, F. G.	Horsham	42
Jones, A. C.	Barnawatha	182
Keele, H. A.	Barnawin	79
Kelynack, P. T.	Bundoora	83
Kemelfield, J.	"Wongala" Woodend	46
Kemp, E. J.	Horsham	15
Kingsley-Newell, F. J.	Shoreham	60
La Fontaine, G.	Mitta Mitta	61
Lawrence, P. H.	"Ralnga," Tarrawarra	89
Lawton, W.	Frankston	56
Light, D. T.	Noradjuha	8
Longerenong Agr. College	Dooen	50
Luke, K. G.	Romsey	32
Maloney, P. J.	Tongala	59
Maybery, A. H.	Mitre	18
Middleton, J. A.	Labertouche	80
Moore, J., and Co.	Yarram	109
Morton, R. S.	Kerrie	36
Myers, J.	Myrniong	76
Murray, M. G.	Lima	19
McIntosh, J.	Merrigum	77
McKenzie, E.	Kerang	68
McKenzie, Mrs. E. J.	Woodford	80
McKenzie, H. P.	Trawalla	23
McNabb, G. A., and Son	Irrewillipe East	191
McPherson, A. L. and J. J.	Kyneton	95
Nancarrow Bros	Kerang	57
Newton, J. M., and Sons	Whorouly	63
Nicholas, M. A.	Sherbrooke	79
Noonan, Mrs. S. A.	Benalla	68
Northcote Children's Farm	Bacchus Marsh	64
Payne, A. E. T.	"Yarra View," Lilydale	78
Payne, T. E. N.	"Woodburn," Kilmore	72
Poole, M. A. and D.	Caldermeade	143
Poole, M. A. and D.	Yannathan	103
Potter, W. J.	Longwarry North	118
Prosser, J. E.	Ondit	40
Read, exors., Estate I. D.	Springhurst	99
Rix, A. A.	Officer	79
Roe, Thomas H. P.	Cobram	15
Sanderson, R. F.	"Pleasant Hill," Kyneton	87
School of Horticulture	Burnley	7
Scott, A. L.	"Wolonga," Kongwak	43
Selwyn-Scott, F. E.	Scotsburn	66
State Experiment Farm	Rutherglen	55
State Research Farm	Werribee	203
Stephens, Dr. F.	Vermont	34
Tanner, F. V.	Peterborough	39
Thomas & Taylor Pty. Ltd.	Hamilton	26
Thompson, H. D. L.	Merricks	41
Till, J. A.	Tongala	58
Tucker, E. G.	Horsham	30
Vagg, T. R.	Officedale	56
Vagg, F. G.	Leongatha	57
Warnock, J. A.	Lima South	77
Waterhouse, H. W. and Son	Pakenham	70
Watson, R. G.	Frankston	21
White, J. C. B.	"Challicum," Buangor	87
Williams Victoree Farms	Dalmore	203
Williamson Bros.	Carlsbrook	119
Wilson, J. L.	Koo-wee-rup North	90
Woori Park Pty. Ltd.	Woori Yallock	137

In addition to the above the following is a list of herds in their respective districts which have given negative reactions to two or more successive tests conducted by departmental veterinary officers, but, inasmuch as replacement cows are only submitted to one test before being admitted to the herds, they cannot be considered as accredited under the Accreditation Scheme which requires, among other things, that no cow shall be admitted to the herds unless it has given two (2) negative reactions at an interval of 60 days, and must be kept in isolation during the period between the two tests.

District.	Herds.	Cattle.
Ararat	11	291
Bairnsdale	5	326
Ballarat	122	3,082
Benalla	43	298
Bendigo	96	3,682
Broadmeadows	50	2,413
Colac	11	345
Doncaster	13	604
Geelong	106	3,903
Hamilton	2	94
Heidelberg	18	555
Horsham	13	650
Morwell	2	202
Orbost	1	107
Portland	7	431
Rutherglen	20	296
Sale	7	532
Terang	1	10
Traralgon	4	218
Wangaratta	38	475
Warrnambool	8	445
Whittlesea	100	4,786
Wonthaggi	7	386
Yallourn	4	268
Yarragon	36	1,630
Yea	26	73

There are also 406 herds in which 16,157 head of cattle have passed one test and may be considered, therefore, to be in process of becoming tubercle-free herds.

STANDARD HERD TEST

Report for Year 1948-49

By C. J. Bradbury, B.Agr.Sc., Supervisor of Herd Testing

Mr. J. Stedman's "Surrey" Jerseys, above, averaged 596·7 lb. butterfat to win this year's Standard Herd Championship.

THE Government Official Herd Test for pure-bred cows, or, as is more commonly known, the Standard Herd Test, had a very humble beginning in 1912, when only 62 cows were tested for five breeders. The scheme grew out of a conference between the agricultural authorities of the day, and a small group of enthusiastic breeders of pure-bred dairy stock. These owners had faith in the dairy ability of their registered cattle, and desired an opportunity to place before breeders and farmers verification of their opinion, which could be gained only in some form of public test or trial.

From this beginning the Standard Herd Test has developed into an institution exercising a powerful influence on dairy cattle breeding in Victoria and plays a big part in the plans of many breeders and farmers. Stud breeders now realize that production records are essential for the successful sale of their surplus stock and this has led to the entry of many more herds into the test.

AVERAGE YIELD OF ALL TESTED COWS

During the year under review, 6,186 cows—a record for the Standard Test—completed the year with an average yield of 341 lb. butterfat. This figure is only 2 lb. below the average for the previous year and can be considered satisfactory as, no doubt, it was adversely affected by the many cows in the new herds that had calved some time before the first test was taken. In addition a greater number of cows were under test this year and also approximately half of the herds included in the average

had little or no previous herd-testing background. Of the 6,186 completed cow-yields for the year, no fewer than 448 exceeded the high level of 500 lb. of butterfat. 85 of these cows produced over 600 lb. and 16 yielded more than 700 lb.

Six cows produced more than 800 lb. butterfat and these included two mature Friesians with yields in excess of 900 lb. The top figure of the year was 917·3 lb. butterfat achieved by "Ingolston Gwen" the property of Messrs. P. W. Goodfellow and Sons, Bunyip.

The seven mature cows in Mr. Stedman's herd gave an average yield of 594·2 lb. butterfat. These include Surrey Bonnie Madeira 11th with 682·8 lb. and Surrey Golden Satisfaction with 676·8 lb. It is of interest to note that Surrey Golden Satisfaction completed a further lactation in the period under review in which she yielded 626·5 lb. butterfat.

Surrey Bonnie Madeira 14th with 569·7 lb. butterfat is the only senior four-year-old in the herd. The three junior four-year-olds averaged 617·3 lb. This select trio includes Surrey Starette 14th and Surrey Lady Doreen 22nd which, with yields of 684·4 lb. and 677·8 lb. butterfat respectively, gained third and fourth positions in the junior four-year-old list.

Surrey Lady Doreen 24th with 622·4 lb. and Surrey Boronia 31st with 604·6 lb. gained third and fifth places in the junior four-year-old list.

Two members of W. C. R. Gay's Reserve Champion herd. The mature Jersey above, Elm Grove Dairymaid 5th, produced 742·8 lb. butterfat. The cow at right, Elm Grove Songstress 5th, yielded 814·9 lb. butterfat as a senior four-year-old.

THE CHAMPION HERD

The "Surrey" Jersey herd owned by Mr. J. Stedman, Appin, again won the herd championship.

In its three years in the Standard Herd Test, the "Surrey" herd has annexed two herd championships and one reserve championship, a performance without precedent in the history of the test. This year with 22 cows, this herd registered the excellent average of 536·8 lb. actual butterfat which was raised to 596·7 lb. when allowances were made for junior animals.

The six junior two-year-olds averaged 441·4 lb. butterfat. These included Surrey Boronia 39th with a yield of 500·2 lb.

THE RESERVE CHAMPION HERD

The 15 Jersey cows comprising Mr. W. C. R. Gay's "Elm Grove" stud, Yarram, take the Reserve Herd Championship this year with an actual butterfat average of 538·9 lb. and an average yield with allowances of 581·5 lb. The seven mature cows in this herd returned the excellent average of 596·9 lb. butterfat. Included in their

number was Elm Grove Dairymaid 5th with a yield of 742·8 lb. Elm Grove Laurette 5th and Elm Grove Duchess 2nd are two other mature cows in this herd with yields exceeding 600 lb. butterfat. With 814·9 lb. butterfat, Elm Grove Songstress 5th, last year's reserve champion cow, has pride of place in the senior four-year-old list, this year, while her herd mate Elm Grove Glowing Dawn, with 654·8 lb. took fourth place. The remaining six junior cows in this herd had high average yields.

OTHER HIGH-PRODUCING HERDS

The 18 "Gowerville" Friesians owned by Messrs. P. W. Goodfellow and Sons averaged 561·6 lb. butterfat with allowances, and took third place in the test. An outstanding performance was the 625 lb. average of the six mature cows. Included in their number was "Ingolston Gwen" with a yield of 917·3 lb. butterfat.

Fourth place was gained by the 16 "Ryelands" Jerseys owned by Mr. J. H. Phillips, Speewa. This herd averaged 557·5 lb. butterfat with allowances. The leading cow of this herd, Ryelands Stylish Dainty, had a mature yield of 602·4 lb. butterfat.

Mr. G. F. Charlton's 1947–48 reserve champion Jersey herd of 21 cows averaged 542·3 lb. butterfat with allowances, and occupies fifth position. Two cows in this herd had yields of over 600 lb. butterfat, and of these, Lumeah Soprano is placed third in this year's senior three-year-old list with a yield of 637·5 lb. Soprano was the leading senior two-year-old in 1947–48.

The "Kooreena" Jersey herd, owned by the estate of the late W. H. Hurrey, took sixth position. With an average butterfat yield of 536·5 lb. with allowances, the 21 cows in the "Kooreena" herd includes three cows with yields greater than 600 lb. One of these cows, Kooreena Yo Yo 14th, yielded 713·8 lb. butterfat. Kooreena Carrie 20th took fifth place in the senior four-year-old list with a production of 645·8 lb. butterfat. Leven Brae Ado Masterpiece sired eighteen of the twenty-one cows in this herd.

Of the 54 herds which averaged over 400 lb. butterfat this year, 22 attained the high average of over 500 lb. when allowances were added. Prominent among these are the 20 Jerseys owned by Mr. J. Mulheron. In its first year under test this herd averaged 530·5 lb. butterfat.

With averages of 528·2 and 527 lb. respectively the 34 Jerseys of Mr. J. A. Till and the 47 Jerseys of Mr. P. W. Lineham, were again among the leaders.

A group of cows from Mr. W. C. R. Gay's Reserve champion herd which produced an average yield of 581·5 lb. butterfat.

The Six Leading Herds in this year's Standard Herd Test

Stud.	Owner.	Number of Cows Entered.	Average Butterfat Without Allowances.	Average Butterfat With Allowances.
			lb.	lb.
Surrey (Jersey)	Stedman, J.	22	536·8	596·7
Elm Grove (Jersey)	Gay, W. C. R.	15	538·9	581·5
Gowerville (Friesian)	Goodfellow, P. W., and Sons ..	18	503·5	561·6
Ryelands (Jersey)	Phillips, J. H.	16	484·5	557·5
Windarra (Jersey)	Charlton, G. F.	21	473·6	542·3
Kooreena (Jersey)	Hurrey, Estate of late W. H. ..	21	480·1	536·5

The 22 Friesians in the Department of Agriculture's herd at the State Research Farm, Werribee, and the 26 Jerseys of Mr. C. J. Jennings, had averages with allowances of 525·4 and 524·7 lb. butterfat respectively.

Other herds with good performances are those owned by Mrs. S. Emmett and Sons, Mr. J. A. Watts, Mr. A. L. Scott, the estate of late S. H. Masters and Son, Mr. E. E. Broad, Messrs. A. E. T. Payne, H. D. L. Thompson, N. H. Young and W. A. Christy. Each of these herds had averages with allowances exceeding 500 lb. butterfat.

A notable performance in this year's test was given by the herd of Mr. L. Williams, Bamawm Extension, which averaged 592·4 lb. butterfat with allowances. This herd, however, having less than 15 cows, was ineligible for the championship.

In the small-herd section the 10 Jerseys owned by Messrs. O. Ronalds and Son with an average of 525·9 lb. butterfat took second place to the 13 cows owned by Mr. L. Williams.

With 11 and 12 cows respectively the herds of the estate of late F. A. Williams, and of Miss I. K. Hearn, were also prominent in the small-herd section.

THE CHAMPION COW

The award for champion cow this year went to the mature Friesian, Victoria Olga, in the herd of the Department of Agriculture, at the State Research Farm, Werribee. Olga produced 25,353 lb. of milk, testing 3·57 per cent., giving a butterfat yield of 905·3 lb. Terling Hypothesis (Imp.) the sire of Olga, has proved himself to be the transmitter of high production while Olga's dam, Victoria Rita, aggregated 4,716 lb. of butterfat in nine lactations. Rita produced 757·5 lb. butterfat this year.

This year's champion cow, Victoria Olga from the Department of Agriculture's Friesian herd at Werribee. Olga gave a mature yield of 905·3 lb. butterfat.

Victoria Olga has produced 2,550 lb. butterfat in her four completed lactations. By producing 68½ lb. of milk on the last

test day Olga showed that she was not merely a prolific producer but able to produce consistently throughout her lactation.

The highest-producing cow for the year, "Ingolston Gwen," a mature Friesian with a yield of 917·3 lb. butterfat, was ineligible for the champion cow award as she did not re-calve within 15 months of her previous calving.

The mature Friesian, Ingolston Gwen, owned by Messrs. P. W. Goodfellow and Sons, was the highest producing cow of the year with a yield of 917·3 lb. butterfat. Gwen, however, was ineligible for the championship (see text).

RESERVE CHAMPION COW

The 1946–47 champion cow, Inverurie Thistledown, gained this year's reserve championship. This mature Ayrshire owned by Mr. J. H. Goddard of Cora Lynn, produced 15,066 lb. of 5·58 per cent. milk, yielding 840·5 lb. butterfat. With this production, Thistledown set a new high level for the Ayrshire breed in the Standard Herd Test in Victoria.

The previous record was held by Thistledown's maternal half-sister, Inverurie Bluebell, with a senior four-year-old production of 826 lb. butterfat. An interesting feature of Thistledown's milk is its remarkably high butterfat content.

OTHER HIGH-PRODUCING COWS

Inverbroom Air Marie, owned by Mr. G. F. Wade is one of the leading Jersey cows under test. Her yield of 831·6 lb. butterfat brings her aggregate to 3,800 lb. produced in six lactations.

With 819·8 lb. butterfat, Bamawm Bonnie Madeira, owned by Mr. L. Williams is another leading Jersey, while Willow Park Duchess 35th, the property of the Estate of the late W. K. Atkinson, again leads the Dairy Shorthorn breed with a yield of 791·1 lb.

Mr. A. E. T. Payne has the leading Guernsey with the 768·2 lb. yield of Yarraview Carol, while Douglas Vale Kassie, owned by Messrs. G. Tandberg and Son, set a high figure for the Australian Illawarra Shorthorn breed with a junior four-year-old yield of 717·9 lb. butterfat. Bangalow Vale Carmine and Tolgarth Illusion (Imp. N.Z.) also yielded over 700 lb. fat.

The Reserve Champion cow, Inverurie Thistledown, mature Ayrshire owned by Mr. J. H. Goddard, produced 840·5 lb. butterfat.

Many other high yields are referred to in the class lists, and others are given in the list of cows producing over 600 lb. butterfat published elsewhere in this report.

SENIOR FOUR-YEAR-OLD CLASS

In the year under review, 407 senior four-year-olds completed their lactations and returned an actual average of 367 lb. butterfat. Among their number were 48 cows with yields of over 500 lb. and 9 with yields of over 600 lb. Jerseys took the leading six positions in this class and last year's reserve champion cow, Elm Grove Songstress 5th, with 814·9 lb. butterfat, gained pride of place for her owner Mr. W. C. R. Gay.

Douglas Vale Kassie, junior four-year-old Illawarra Shorthorn owned by Messrs. G. Tandberg and Son, yielded 717·9 lb. butterfat.

Francliff Prudence, with 680·4 lb. butterfat gained second place for Mr. R. C. Broad, while Shenstone Gem 6th, gained third position for Mrs S. Emmett and Sons, with a yield of 670·1 lb. butterfat. Elm Grove Glowing Dawn, another member of W. C. R. Gay's reserve champion herd is in fourth place with 654·8 lb. butterfat.

Kooreena Carrie 20th (645·8 lb. butterfat) and Rutland Noella 3rd (631 lb.) took fifth and sixth place in the senior four-year-old list for the estates of the late W. H. Hurrey and the late S. H. Masters and Son respectively.

JUNIOR FOUR-YEAR-OLD CLASS

The junior four-year-old class totalling 474 cows and averaging 363 lb. butterfat includes 44 cows which produced over 500 lb. butterfat, five with yields exceeding 600 lb., and one of 718 lb. butterfat.

Leading this class with a yield of 717·9 lb. butterfat is Douglas Vale Kassie, the property of Messrs. G. Tandberg and Son. This is the highest yield ever recorded for an Australian Illawarra Shorthorn in Victoria.

Elm Grove Songstress 6th with a yield of 684·9 lb. butterfat took second place in this class for Mr. P. W. Lineham, while Surrey Starette 14th and Surrey Lady Doreen 22nd, members of the Mr. J. Stedman's champion herd, took third and fourth positions with productions of 684·4 lb. and 677·8 lb. respectively.

The Jersey, Mornmoot Fancy Starbright 16th, owned by Mr. N. H. Young, yielded 617·3 lb. butterfat, while the Guernsey, Avonview Diana owned by Mr. A. Fixter took sixth place.

Top Guernsey of the year, Mr. A. E. T. Payne's mature cow, Yarraview Carol produced 768·2 lb. butterfat.

SENIOR THREE-YEAR-OLD CLASS

With a class average of 351 lb. butterfat, the 556 senior three-year-olds include 44 cows with yields of over 500 lb. Three of these exceeded 600 lb. butterfat and two, more than 700 lb.

Leading this class with 775·2 lb. butterfat, Mr. J. H. Goddard's Ayrshire, Inverurie Flirt, was followed by Mr. A. E. T. Payne's Yarraview Golden Daffodil, with a yield of 736 lb. This cow produced 728 lb. butterfat as a junior three-year-old.

Leading junior three-year-old Jersey, Grangeville Goldie 2nd, owned by Mr. E. E. Broad, yielded 648·5 lb. butterfat.

Lumeah Soprano, leader of the senior two-year-olds last year, gained third place for Mr. G. F. Charlton with a yield of 637·5 lb. butterfat.

Waroin Delightful Butterfly took fourth place for Mr. H. A. Keele, with a yield of 596·5 lb. butterfat, while Glenvalley Duchess Pride and Shenstone Linda 12th gained fifth and sixth position for Messrs. Gilmour Brothers and Mrs. E. Emmett and Sons with yields of 586·4 lb. and 585·8 lb. respectively.

JUNIOR THREE-YEAR-OLD CLASS

The junior three-year-old class totalled 678 cows, averaging 331 lb. butterfat. This number includes 26 cows with yields of over 500 lb. and six with yields exceeding 600 lb.

Grangeville Goldie 2nd, owned by Mr. E. E. Broad, leads this section with a butterfat yield of 648·5 lb. from Mr. L. J. Felmingham's Alexandra Golden Lass, which yielded 630 lb.

"Inverbroom Air Marie", Mr. G. F. Wade's mature Jersey, produced 831·6 lb. butterfat.

Surrey Lady Doreen 24th, gained third place for Mr. J. Stedman with a yield of 622·4 lb. butterfat. This cow yielded 558·3 lb. as a junior two-year-old.

The highest producing Dairy Shorthorn, Willow Park Duchess 35th, is owned by the estate of W. K. Atkinson (791·1 lb.).

The Guernsey breed is represented in fourth position by Mr. W. J. Leggate's, Englauscot Blossom with a yield of 622 lb. butterfat.

Surrey Boronia 31st, another member of this year's champion herd, gained fifth position with a yield of 604·6 lb. butterfat. It will be remembered that Boronia 31st produced 539 lb. butterfat as a junior two-year-old last year. Sixth place is occupied by Mr. J. S. Watts' Langi Janie with a yield of 603 lb.

SENIOR TWO-YEAR-OLD CLASS

With a class average of 310 lb. butterfat, the 524 senior two-year-olds include 10 cows with yields of over 500 lb. butterfat,

The leading junior two-year-old, Yarraview Admiration, is owned by Mr. A. E. T. Payne. This young Guernsey produced 621·5 lb. butterfat.

and one, Melrock View Moleen produced 615·5 lb. butterfat. This member of Mr. J. Mulheron's herd leads the class and is followed by Mr. C. P. Maloney's, Larconia Posy 5th (556·3 lb. butterfat). Elm Grove Island Queen 6th with a yield of 544·3 lb. gained third place for Mr. P. W. Lineham.

Mr. H. D. L. Thompson is represented in fourth place by Lynbrae Rosette with a yield of 541·2 lb. while fifth and sixth places were taken by Lynbrae Rosette and Ballam Vera's Virginia, with yields of 532·4 lb. and 519·8 lb. respectively. Both of these cows are owned by Messrs. Gilmour Brothers.

Daisy 51st, with a yield of 566·8 lb. butterfat, eclipsed Yarraview Le Mode's record as a junior two-year-old. This figure has now been surpassed by representatives of both the Guernsey and Jersey breeds. The Guernsey, Yarraview Admiration, a daughter of Yarraview Le Mode, leads the class with 621·5 lb. butterfat. Mr. L. Williams' Elenko Primrose, with a yield of 605·4 lb. took second place. Mr. J. A. Till's, Eurarie Princess, with a yield of 545·4 lb. butterfat occupies third position.

Kingsvale Rosella 93rd gained fourth place for Messrs. J. Anderson and Son with a yield of 543·1 lb. butterfat, while Mr. C. S. Walker's Warwick Design's Mauve, with a yield of 525·4 lb. is in fifth position. Sixth place is occupied by Mr. H. H. Dowel's Inverell Stella 5th, with a yield of 518·3 lb. butterfat.

Standard Herd Test Booklet

The Standard Herd Test Report containing herd records for quarter ended 30th June, 1949, and a list of cows qualified to be placed on the Advanced Register of Merit, will be published towards the end of the year. A free copy of the report may be obtained from the Department of Agriculture, Melbourne, C.2.

JUNIOR TWO-YEAR-OLD CLASS

With an actual class average of 293 lb. raised to 413 lb. with allowances the junior two-year-olds have this year returned the highest average with allowances for any age group.

The 1,445 heifers in this class include ten with yields of over 500 lb. butterfat including two with yields exceeding 600 lb.

It will be recalled that only last year, Mrs. W. Carson's heifer, Melksham

Winner of the senior two-year-old section, Melrock View Moleen yielded 615·5 lb. butterfat. This Jersey comes from the herd of Mr. J. Mulheron.

(continued on page 428.)

Irrigated Pastures in Victoria

By A. Morgan, B.Agr.Sc., Senior Irrigation Officer

Parts 1, 2, 3 and 4 of this series appeared in the March, May, June and August issues of the Journal

WHITE CLOVER

It has been well expressed by W. M. Ware in "Miscellaneous Publication No. 46 (1925)", issued by the Ministry of Agriculture and Fisheries, Great Britain, that "the community of plants known collectively as White Clover consists of individuals exhibiting great variation in characters such as size of leaf, flower, and seed, lasting powers, and time of flowering".

White clover, says Mr. Ware, was probably first cultivated in the Low Countries, and this probably gave rise to the name White Dutch Clover.

The first mention of its cultivation in England was in 1757 (Lisle, "Observations in Husbandry," Vol. 2, pages 41 and 55). The value of the plant in agriculture arises from the following qualities, among others:—

(*a*) Excellence as sheep feed, and for dairy stock.
(*b*) Tap-rooting habit.
(*c*) Addition of nitrates to the soil.
(*d*) Suppression and exclusion of weeds.
(*e*) Formation of "sole" in pasture, by pushing in between the erect stems of other pasture plants.
(*f*) High protein content of hay.
(*g*) Ability to maintain itself on grass land by seeding.
(*h*) Power of spreading by creeping stems.
(*i*) Comparative freedom from disease.

To elaborate on the above:—

(a) Value as sheep and cattle feed

The extent of cultivation of white clover in the irrigation districts where dairying is a major industry (mainly those with 1 in 1 water rights) is sufficient proof of its value as cattle feed. With sheep, grazing trials at the State Research Farm, Werribee have shown that pasture with a good white clover content is capable of maintaining a very high carrying capacity, both dry sheep and breeding ewes. More attention is required to maintain stock health with sheep than is the case with dairy cattle, but again the experimental work at Werribee has demonstrated that the necessary precautions to maintain the sheep in sound condition are not unduly expensive.

(b) Tap-rooting habit

The tap-root of the young plant and also the main roots subsequently developed from the creeping stems, will penetrate 8 to 10 inches. Soil type has an important effect in this regard.

(c) Addition of nitrates

Mr. F. Penman, Deputy Chief Chemist of the Department of Agriculture, has investigated the available nitrogen in soils under

White clover on reclaimed salt-affected land. (Property of Mr. J. Messer, Pyramid Creek).

non-irrigated and irrigated conditions, and the results were reported in the September, 1931, and February, 1940, issues of the Journal of Agriculture. Quoting from Mr. Penman's report on the non-irrigated soils under pasture :—" For the present purpose we may consider 'available nitrogen' of the soil as inorganic nitrogen, i.e., nitrogen in the form of nitrate, nitrite, or ammonia. Of these constituents, it soon became manifest in the soils examined that nitrite was of no practical importance because of its minute concentration."

It was found that, in pasture soils as well as in cultivated soil, the amount of nitrites was negligible. Nitrate nitrogen was found to be of low concentration in pasture soil, whereas it often reached a high concentration in cultivated soil. Ammoniacal nitrogen does not accumulate in cultivated soils, but it ranges about 10 parts per million in pasture soils.

Dealing with soil under irrigation trials with pasture at the State Research Farm, Werribee, Mr. Penman found that the content of total nitrogen in the surface 6 inches was 122 parts per 100,000 of dry soil in 1935 as compared with 82 parts per 100,000 of the same soil in 1914.

A notable rise in soil nitrogen in the surface soil had occurred as a result of the growth of irrigated pasture in which white clover was the most important legume. It was also shown by Mr. Penman (Journal of Agriculture, February, 1940, page 90) that the increase in total nitrogen was progressive from " No irrigation " through the " six waterings of 3 inches " and " six waterings of 4 inches " up to " six waterings of 5 inches ". A decrease was then noted on the " six waterings of 6 inches ", but further tests indicated that the theory that the organic matter had been leached out by the heavy irrigation was not supported by chemical analyses. The fact that the white clover content followed the nitrogen accumulation figures to a large extent, shows the value of the white clover in this respect.

White Clover (*Trifolium repens*). A.—Plant. B.—Floret (enlarged). C.—Fruiting head (slightly enlarged).

(d) Suppression and exclusion of weeds by white clover

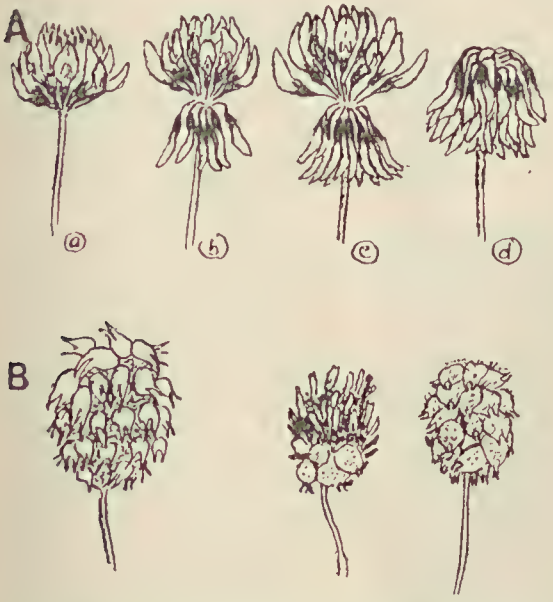
This feature was brought out clearly earlier in this series on the effects of irrigation treatment and topdressing with superphosphate on white clover percentage in pastures. It is noteworthy, however, that the dandelion, which has become a nuisance in some pastures on Gunbower Island and elsewhere, appears to be capable of suppressing white clover under some conditions, and, as the watering and manuring treatments in these cases appear to be satisfactory, it is possible that the dandelion gains control as the result of certain grazing managements.

(e) Formation of "sole" in pasture by white clover

Where the ground surface is visible through the pasture growth, the pasture is described as having a poor "sole", and, in botanical analyses of swards, the absence of "sole" is expressed by giving the percentage area of "bare ground" showing at the time of the test.

If conditions of moisture and fertility are suitable to white clover, the plant very effectively covers the ground between the grass plants, and by growing through the grasses forms a most excellent "sole". As pointed out in the preceding paragraph, this excludes and suppresses weed growth, and it is reasonable also to assume that it reduces the evaporation from the soil surface and thus increases the efficiency of the irrigation water applied.

Dandelion invading irrigated pasture on Gunbower Island.



Showing various stages in the turning-down of flowers of a White Clover flower-head (A) and the characteristic "bladdery" appearance of a mature Strawberry Clover flower-head (B).

(f) High protein content

The milking qualities of good pasture with a high proportion of white clover are well known, and this is considered to be due largely to the high protein content of the clover. During the 1931–32 season, a yield-sampling trial on a rotationally-grazed field at the State Research Farm, Werribee, indicated that the protein content of the pasture actually eaten by the sheep was very high; one case, quoted on page 100 of the February, 1937, Journal of Agriculture, showed the protein content as 27·4 per cent.

(g) Ability to maintain itself on grass land by seeding

It has long been known that, given reasonable moisture and fertility conditions, white clover will spread rapidly by seed. Some of this seed is not digested by grazing animals, and, in some districts, the plant has been propagated by distributing the cow-yard manure over the paddocks. In other cases the plant has been introduced by feeding out grass hay purchased from a property carrying good swards of white clover. During the 1943-45 droughts, the white clover in the Werribee irrigation district suffered severely, but, when moisture conditions were again favorable, a remarkable regeneration of the pastures occurred from seed which had been lying dormant in the soil. The capacity to do this varies with the strain of white clover.

White clover is undoubtedly the most important legume in the dairying pastures of the Victorian irrigation districts. When purchasing seed for sowing permanent

perennial pastures, the choice of a suitable strain of the plant is of paramount importance.

While factors such as palatability may in future need to be taken into account, the emphasis at present is on productivity and longevity of the strain. Tests conducted at the Department's Pasture Plant Research Station at Burnley during 1938–41 gave the following results :—

PRODUCTIVITY OF WHITE CLOVER STRAINS, PASTURE PLANT RESEARCH STATION, BURNLEY, SEASONS 1938–41.

Strain.	lb. of Dry Matter.				
	*1938.	1939.	1940.	*1941.	Total.
New Zealand Certified ..	15·9	41·8	43·9	14·5	116·1
Victorian Irrigation	19·8	48·4	48·7	13·9	130·8
White Dutch ..	10·2	37·2	31·0	8·9	87·3
Kentish ..	2·3	23·1	36·3	12·6	74·3
Ladino	12·5	41·1	49·2	17·0	119·8

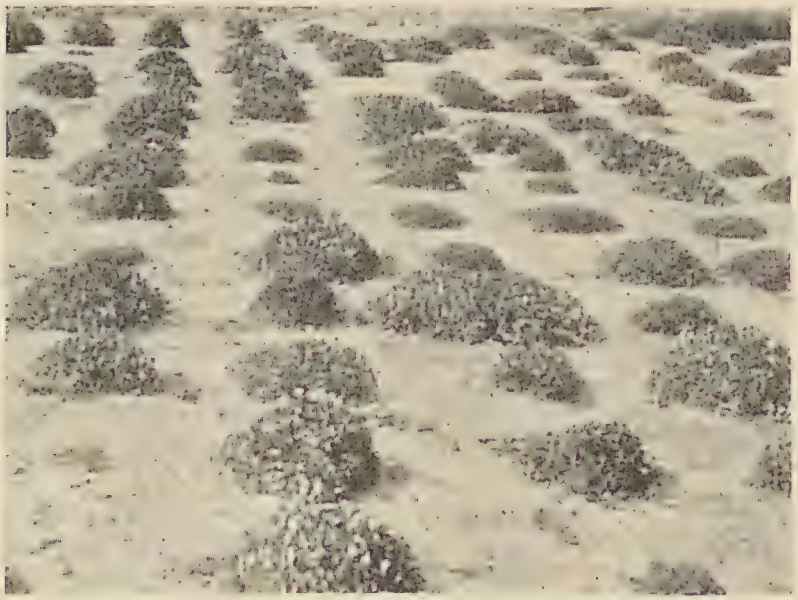
* Part of year only.

F. R. Drake, J.Dep.Agr.Vic.,1942, p. 333.

To quote from Mr. Drake's paper:— "Over the full period, the Victorian irrigation type gave the highest yield, with Ladino and New Zealand certified not far behind. During the last two seasons, Ladino was slightly ahead, and showed no sign of being other than a persistent type, at least over the period of this trial. Kentish is also a highly-persistent type, tending to improve rather than deteriorate with age. The White Dutch plots, on the other hand, were badly thinned out by the end of the trial".

At that time, there was only one source of Irrigation White Clover (i.e., Messrs. Hamley and Jackman, Dingee). Seed has more recently been available from Tongala (Mr. J. Bullingham). It is probable that, as more growers enter this industry, differences in the performance of White Clover strains from the various irrigation districts will become known through tests. Such factors as quantity of seed produced and capacity for regeneration from seed following drought periods are of practical importance to irrigators, and it is probable that the various strains differ considerably in these respects. The use of DDT to control insects which reduce yield of seed is a recent development.

The seeding rate for white clover in a pasture mixture for irrigation is usually 1 lb. per acre, the cost per pound being high in comparison with other seeds. To establish a good pasture quickly, however, this seeding rate may with advantage be increased to 2 or 3 lb. per acre, and the more progressive irrigators are making this a regular practice.



Single plants of white clover in test plots at Burnley gardens.

Sown at the rate of 1 lb. per acre, the maximum possible plants per square yard is 150. In the field more than five or six plants per square yard are seldom obtained. The germination percentage of the seed in laboratory tests is around 90 per cent., so it must be assumed that the low field survival is due to such factors as excessive depth of sowing, &c.

Even though the seed is sown practically on the surface it is so small that it becomes too deeply buried. In any case, the plants which survive spread so quickly,

under favorable conditions of moisture and phosphate supply, by means of creeping stems (stolons) which root at each joint (node), that in a season or two the white clover has formed a continuous sole.

In some districts the dominance of white clover, while it is the main contributor to high production of green feed, causes trouble due to "bloat" of cows and to the development of a feed flavour in the cream. In the Maffra-Sale irrigation district, the former frequently causes higher mortality than in the northern districts.

STRAWBERRY CLOVER

Strawberry clover is adapted to withstand both wetter and drier conditions than white clover, but, in general, is somewhat less productive. Prolific strains which have developed in irrigated pastures at Cohuna, Swan Hill and elsewhere have not been exploited in regard to seed production, and only small areas of Palestine strawberry clover have been sown. A slightly higher tolerance to "salt" has resulted in strawberry being dominant to white clover in some pastures at Cohuna, while in the Maffra-Sale district the plant is common and in many paddocks was probably established prior to irrigation.

Strawberry Clover (Trifolium fragiferum).
A.—Plant. B.—Leaf. C.—Leaflet. D.—Flower head. E.—Single flower.
F.—Fruiting head. G.—Pod and seed.
[West Aust. Dept. of Agric.

Primarily with the idea of catering for unavoidable irregularities in grading, a few ounces of strawberry clover are often included in the permanent perennial pasture mixture. In recent years, however, Goulburn Valley irrigators have simplified their seedings and tend to concentrate on perennial rye grass and white clover.

Although as mentioned above, strawberry clover has some claim to "salt" tolerance, it will not be found satisfactory to attempt to establish it on "salty" land where white clover will not strike, as the actual difference in tolerance is small. In many cases, where the strawberry clover has established itself as a volunteer on reclaimed land, the preponderance of strawberry to white clover is as much an indication of the excessive irrigation as of anything else.

The general characters of strawberry clover (i.e., method of spread, &c.) are not particularly different from white clover, but they may be separated by observing the following features :—

STRAWBERRY CLOVER	Veins of leaflet closely-spaced, much-branched, curved ; or
	Base of each flower in head clothed with shining white hairs ; or
	Flowers in head becoming bladdery in maturing heads.
WHITE CLOVER	Veins of leaflet wide-spaced, little-branched, straight ; or
	Base of each flower in head devoid of hairs ; or
	Flowers in head turning down as they mature.

The seed of strawberry clover is larger than that of white clover.

Red Clover (Trifolium pratense).

A.—Habit. B. and C.—Flower. D.—Fruit showing cap which falls off to liberate seed. E.—Seeds.

[West Aust. Dept. of Agric.

PERENNIAL RED CLOVER (COW GRASS)

Cow grass is a strong-growing, short-lived perennial with showy flowers and hairy leaves. It is included at the rate of 2 lb. per acre in the Department's perennial pasture mixture. New Zealand markets a more persistent strain known as Montgomery Red Clover, and a variety with a modified creeping habit is occasionally encountered. The standard flower colour is reddish-purple; very rarely, plants with white flowers are noticed. Further details of this clover may be obtained in a pamphlet, "Clovers and Allied Species," issued free of charge on application to the Department of Agriculture, Treasury Place, Melbourne, C.1.

ALSIKE CLOVER

Alsike clover, which has flowers and leaves similar to those of white clover, has some tolerance for wet conditions, and, although normally a short-lived perennial, may persist under these conditions.

For all practical purposes, it may be bracketed with cow grass and the details concerning it may be found in the pamphlet mentioned.

SUBTERRANEAN CLOVER

Subterranean clover has proved so valuable under both irrigated and dry conditions that a considerable amount of published information is available. The Department issues a free pamphlet on this clover, and many papers on it have been published by the Commonwealth Scientific and Industrial Research Organization and by other State Agricultural Departments and such bodies as the Royal Society of Victoria (Aitken and Drake).

Under correct management subterranean clover should not assume any great importance in a perennial pasture. Its features under irrigation will be discussed in later instalments in connexion with permanent annual pasture.

A further instalment of this series will appear in a subsequent issue of the Journal.

Preservation of Textiles, Leather, Etc.

Defence Research Laboratories have recently published Circular 12, "Fungicidal Treatment of Textiles, Leather and other Materials," by W. R. Hindson and K. N. Mortensen, October, 1948. A limited number of copies of the circular are available to industrialists and others, and these may be obtained free on application to General Superintendent, D.R.L., Private Bag No. 4, P.O., Ascot Vale.

The preservation of organic materials, such as tents, tarpaulins, hessian bags, leather and other equipment was a major problem during the war in New Guinea, the East Indies and Burma, and much work was done at D.R.L. along these lines. With tropical and near-tropical climatic conditions prevailing for some months over much of Australia, many of our industries are affected by this problem. Circular 12 reports the work done at D.R.L. to apply war-time findings to to-day's needs.

The circular describes the materials and conditions which allow fungal attack, and details the best fungicidal treatment for each case. A distinction is made between the fungi that can digest cellulose, and the so-called "mildews," which do not. These latter do not usually weaken the cellulosic material, but they are generally objectionable because they discolour textiles, give rise to a musty odour, contaminate associated equipment, and undermine waterproofness, flexibility and electrical resistance. The measures to prevent growth of "mildew" should be especially valuable to industry.

Materials for which treatments are recommended comprise:—hessian, cotton and flax goods, rope, cordage and twine, thread, paper, timber, cork, wool, leather, adhesives, fats and waxes, plastics, rubber, paints, lacquers, and optical and photographic equipment. A brief summary of recommended treatments is given, with cross-references to the detailed discussions in the text. The circular includes a comprehensive bibliography.

CERTIFIED VEGETABLE SEEDS

List of Growers for 1948-49 Season

By R. F. HENDERSON, B.Agr.Sc., Horticultural Instructor

CERTIFIED FRENCH BEAN SEED

FOR twenty years or more, bean growers throughout Victoria have experienced serious losses due to the scourge of a bacterial disease called "Halo Blight," a disease which can attack the bean plant at any stage of its growth and render the crop unfit for market. Growers can readily recognize this disease by its yellow round spot or "halo" on the leaf and the "grease-spotting" on the pods.

In 1945–46 season a small number of growers commenced growing clean seed under the French bean Seeds Certification Scheme and each year the amount of certified seed produced has increased. The 1948–49 season has been the most successful to date, giving a production of over 1,500 bushels of certified Brown Beauty and Hawkesbury Wonder seed. This quantity represents approximately 10 per cent. of the total area sown with certified seed.

Most of the crops not certified carried only a mere trace infection, perhaps showing only one diseased plant per acre. This seed is almost up to certified standard and is recommended for use in the production of green bean crops. Large quantities of seed of this standard are available and may be obtained from East Gippsland growers. Further information on this matter may be obtained on application to the Horticultural Superintendent, Department of Agriculture, Treasury Gardens, Melbourne, C.2.

All of the certified Brown Beauty seed will be retained for seed crops to be sown in 1949–50 in East Gippsland. From this crop it is hoped to supply green bean growers with certified seed at the end of the season. Certified Hawkesbury Wonder seed, however, is available now for these growers.

GROWERS OF CERTIFIED BEAN SEED FOR 1948–49 SEASON.

Grower.	Address.	Acreage.
BROWN BEAUTY.		
Aiken, A.	Orbost	2
Butters, A.	Orbost	3
Hall, A.	Wangrabelle	1
Lee, P.	Dargo	2
McLeod, K.	Wangrabelle	2
Phelan and Websdale	Dargo	20
Spaull, B. T.	Dargo	5
Thurlby, H.	Dargo	13
Walker, W. H.	Gipsy Point	4
Warren, J.	Orbost	10
HAWKESBURY WONDER.		
Lynn, K.	Orbost	8
Murphy, J.	Orbost	8

APPROVED TOMATO SEED

Tomato seed crops grown and passed this season under the Department's "approval" scheme are as follow:—

Variety.	Grower.	Address.	Acreage.
Pale Leaf (Yellow Top)	McKenzie, D. and D. J.	Marong, via Bendigo	½
Tatinter	Van Staveren, J...	Shepparton East	1
	McKenzie, D. and D. J.	Marong, via Bendigo	1
Tatura Dwarf Globe	Van Staveren, J...	Shepparton East	½
Victorian Dwarf	McKenzie, D. and D. J.	Marong, via Bendigo	1

Quality Characteristics of the Victorian Wheat Crop

By E. J. O'BRIEN, A.A.C.I. Cereal Chemist

SEASON 1948-49

★ ★

During harvesting operations, weekly samples were taken from receivals at each of the Victorian grain elevators ; 904 such samples were examined and a detailed report was made to the Grain Elevators Board. The object of this present report is to summarize the results obtained, and to record the quality of Victorian wheat for the 1948-49 harvest.

Although most of the wheat under discussion in this report has been milled or exported, and, although the figures presented here have little application to present grain movements, it should be understood that preliminary information on quality aspects was available to interested parties from the commencement of harvesting.

REVIEW OF 1948-49 SEASON

CLIMATIC conditions in the main wheat-growing areas of Victoria have been reviewed in detail by officers of the Department of Agriculture in reports published in the April issue of this *Journal* on wheat crop competitions for 1948. The first three months of the year were unusually dry but rain in April allowed normal cultivation, while satisfactory rains in May and June provided a good start to the season. Dry conditions then prevailed until October, when satisfactory rains were again received. These rains assisted the later crops and in the Wimmera resulted in record yields, but in the Mallee the rain was too late to save early crops which had been adversely affected by the particularly severe spring.

Finishing conditions were mild and favoured high yields where the early part of the season had been satisfactory. Rains in January delayed harvesting in parts of the Wimmera but the grain quality was not adversely affected.

The exceptionally high yields of up to 68 bushels per acre in the Wimmera more than balanced the poor yields in parts of the Mallee so that the total production was well above average. Seasonal yield variations (bushels per acre), for Victorian wheat harvests are shown in Table 1 ; area and total grain production are also shown for preceding years, together with appropriate averages.

TABLE 1.—WHEAT PRODUCTION IN VICTORIA.
(*Grain Only.*)

Year.	Area.	Production.	Yield.
	Acres.	Bushels.	Bus./ac.
1938–39.. ..	2,748,362	18,104,369	6·6
1940–41.. ..	2,672,728	13,521,422	5·1
1941–42.. ..	2,757,080	46,953,840	17·0
1942–43.. ..	2,145,156	41,803,107	19·5
1943–44.. ..	1,793,428	19,733,322	11·0
1944–45.. ..	2,141,729	3,497,677	1·6
1945–46.. ..	3,251,393	29,633,760	9·1
1946–47.. ..	3,501,135	48,970,908	14·0
1947–48.. ..	3,227,162	46,962,385	14·6
1948–49.. ..	*3,150,000	49,500,000	15·7
Average for 10 years ending 1939	2,988,795	40,380,602	13·5
Average for 9 years ending 1949 ..	2,737,756	33,397,380	12·0

* Estimate only.

WHEAT VARIETIES IN VICTORIA

Tables 2 and 3 show the percentage sowings of the more important wheat varieties in comparison with similar information for previous years.

It is seen that Quadrat, Insignia, Pinnacle, and Diadem have increased in area sown and all other varieties have shown corresponding decreases.

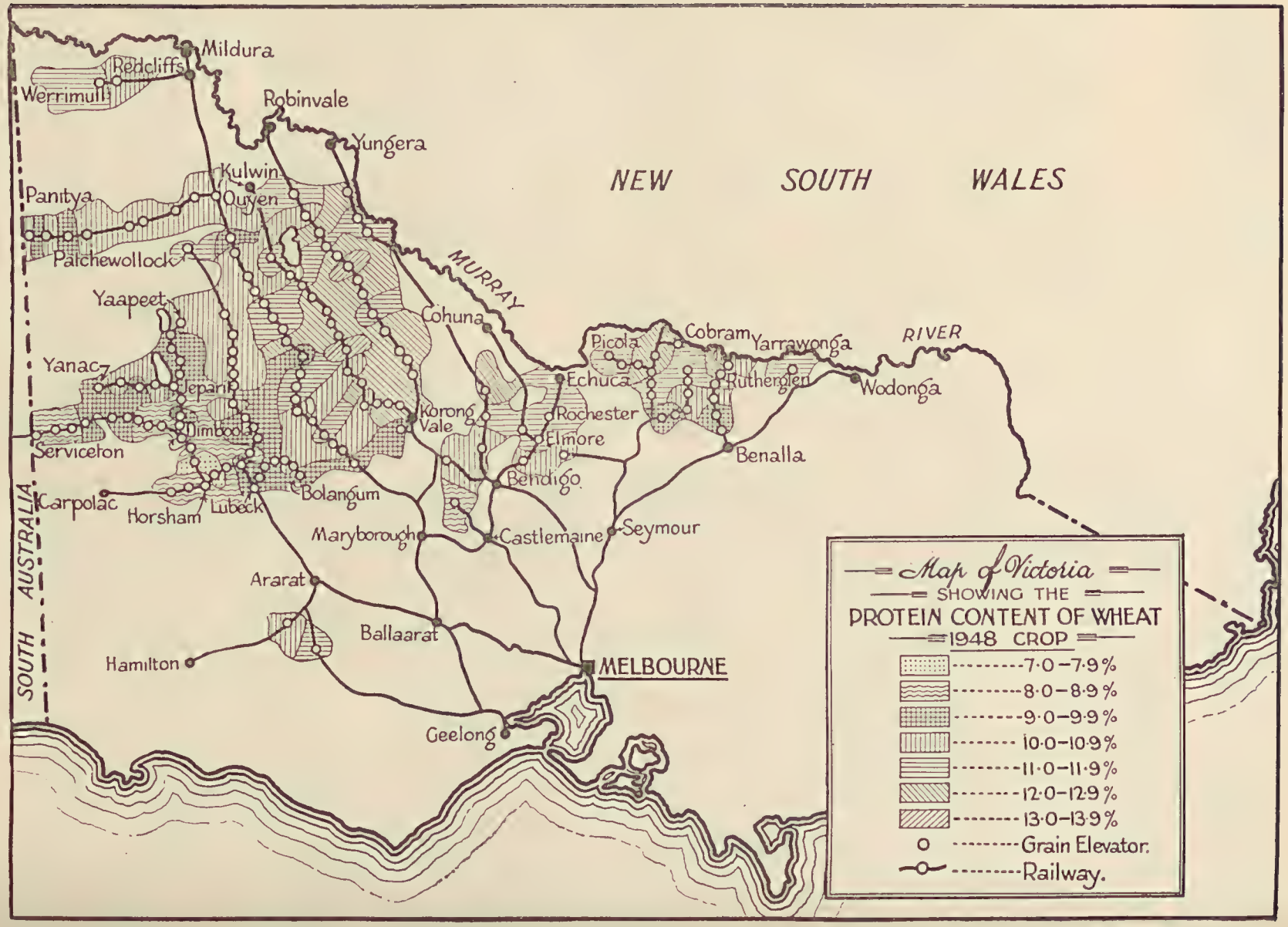

Mildura
Redcliffs
Werrimull
Robinvale
Yungera
Kulwin
Ouyen
Panitya
Patchewollock
Yaapeet
Yanac
Jeparit
Nimbool
Serviceton
Carpolac
Horsham
Lubeck
Bolangum
Cohuna
Korong Vale
Boort
Echuca
Picola
Cobram
Yarrawonga
Rutherglen
Wodonga
Rochester
Elmore
Bendigo
Benalla
Maryborough
Castlemaine
Seymour
Ararat
Ballaarat
Hamilton
MELBOURNE
Geelong
NEW SOUTH WALES
MURRAY RIVER
SOUTH AUSTRALIA
Map of Victoria
SHOWING THE
PROTEIN CONTENT OF WHEAT
1948 CROP
7·0–7·9 %
8·0–8·9 %
9·0–9·9 %
10·0–10·9 %
11·0–11·9 %
12·0–12·9 %
13·0–13·9 %
Grain Elevator.
Railway.

TABLE 2.—WHEAT VARIETIES SOWN IN VICTORIA.

(*Percentage of Total Wheat Area.*)

Variety.	1948–49.	1947–48.	1946–47.	1945–46.	1941–42.
Quadrat ..	42·2	37·2	26·9	19·9	0·3
Insignia ..	11·8	1·9	..	..	..
Bencubbin ..	7·3	9·2	8·4	6·0	5·1
Magnet ..	7·2	12·0	9·1	6·4	1·5
Ghurka ..	7·1	12·8	20·3	25·7	52·7
Pindar ..	5·7	9·1	9·8	7·6	0·1
Pinnacle ..	4·8	1·3	..	..	..
Ranee 4H ..	2·5	6·4	8·8	6·9	18·2
Regalia ..	1·7	4·0	4·8	4·1	2·5
Diadem ..	1·3	..	..	..	..
Mixed Seed..	..	..	4·1	18·9	..
All others ..	8·4	6·1	7·8	4·5	19·6

The continued expansion of the area sown to Quadrat weakens Victorian wheat quality, but the other varieties tend to counter this trend toward lower baking quality. The quality of Diadem is much better than the other varieties listed but, as yet, this variety has had little influence on Victorian quality.

PROTEIN MAP

The protein map has been constructed from the results of testing weekly samples representing 34 million bushels from grain elevators throughout the State. From the weekly samples, weighted mean values were determined and these results are plotted on the map to give a general picture of the protein distribution throughout Victoria.

Although the overall protein level, as shown in Table 4, is slightly higher than for last year, the relative distribution is similar to that of preceding years. The southern Wimmera is very low, whereas the southern Mallee and eastern Wimmera are relatively high. The protein content is thus directly related to the yield and seasonal conditions in these areas.

TABLE 3.—LEADING WHEAT VARIETIES SOWN IN DISTRICTS.

(*Percentage of Wheat Area.*)

Mallee.		Wimmera.		Northern.	
Quadrat	34·3	Quadrat	61·2	Quadrat	52·5
Insignia..	24·5	Pinnacle	9·7	Magnet	13·1
Bencubbin	14·0	Magnet	9·6	Ghurka	9·5
Pindar ..	10·4	Ghurka	7·5	Pinnacle	4·7
Ghurka ..	5·6	Diadem	2·8	Baldmin	4·1

PROTEIN DISTRIBUTION

Figure 1 shows the frequency diagram for the 904 samples examined for protein content. This season the range in protein content throughout all the samples was 7·4 to 14·1 per cent. with an average of 10·5 per cent. This average compares favourably with the protein content (10·3 per cent.) of the f.a.q. sample. The range is the extreme variation throughout all the samples examined but, within each elevator there is a smaller range of protein content due to differences in soil and cultivation practices. This variation is of the order of 1·5 per cent. for composite samples from any elevator. Individual deliveries consisting of the wheat from one or two growers, however, may be expected to differ by more than this amount from the mean value.

Figure 2 presents the data in a slightly different form. Here, the quantity of wheat produced at the different protein levels is shown and it may be seen how much wheat in the State or a district is above or below a pre-determined level.

TABLE 4.—SEASONAL PROTEIN VARIATION.

(*Calculated on 13·5 per cent. Moisture Basis.*)

Year.		1942–43.	1943–44.	1945–46.	1946–47.	1947–48.	1948–49.
Number of elevators sampled	..	117	136	137	139	143	149
Protein content (average)	%	10·6	10·2	11·7	11·2	9·5	10·5
Protein content (variation)	%	8·8–13·7	7·9–12·3	9·9–13·2	8·7–15·0	6·9–14·9	7·4–14·1
Protein content (range) ..	%	4·9	4·4	3·3	4·3	8·0	6·7
Protein content (f.a.q. sample)	%	10·9	10·1	11·6	10·9	9·6	10·3

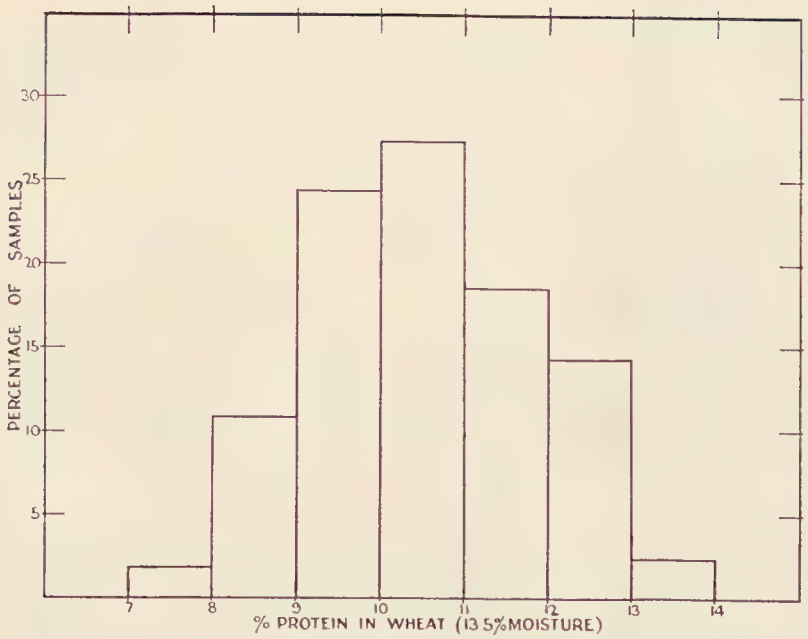


Fig. 1—Frequency diagram showing percentage of samples falling within each 1.0 per cent. protein range.

It is generally recognized that the minimum protein content of wheat from which a bread flour can be produced is 9 per cent. Figure 2 shows that 13 per cent. or approximately six million bushels of this season's crop may be classified as unsuitable for bread making purposes on account of its low protein content. However, this wheat could and should be utilized for purposes which do not require a protein content greater than 9 per cent. and any excess blended with high protein wheats. Segregation of this portion of the Wimmera crop would thus exert an improving influence on Victorian bread quality.

GROUPING OF ELEVATORS ACCORDING TO PROTEIN CONTENT.

Tables 5, 6, 7, and 8 list the elevators in the various districts according to protein content. At the foot of each column is shown the proportion of the district and State each column represents. These tables really elaborate the data shown graphically in Figure 2.

BAKING AND ANALYTICAL RESULTS

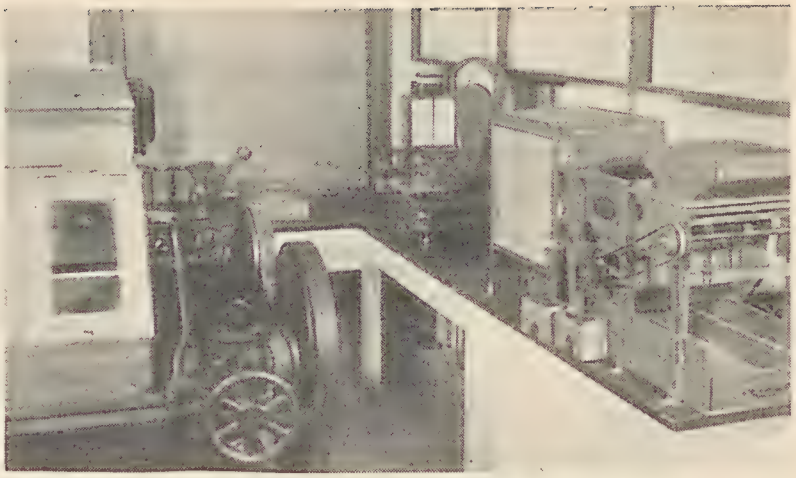
Table 9 shows the analytical figures obtained from composite samples, each representing a particular protein range within a district as listed in the previous tables.

The flour samples were obtained by milling on an experimental roller mill to give a flour yield similar to that obtained in commercial practice. The Pelshenke figures are indicative of strength or weakness in wheat. The higher the Pelshenke figure, the greater is the potential strength of the

Fig. 2—Frequency diagram showing percentage of total wheat produced falling within each 1 per cent. protein range.

wheat. Pelshenke figures of from 30 to 45 generally classify the wheat as weak from a bread-making point of view. This classification of all samples is confirmed by the Valorimeter numbers obtained from tests made on the Farinograph. Here again no sample can be classified outside the weak range.

The water absorptions are measured by the Farinograph, and consequently the yield obtained in a bakery are in order of protein content with very little district effect. The diastatic activity as represented by the maltose figure is very low throughout the series and indicates the necessity for diastatic additions in the bakery.



Experimental milling equipment at the State Laboratories

TABLE 5.—WIMMERA ELEVATORS.

(*Protein Content.*)

7·0–7·9%	8·0–8·9%	9·0–9·9%	10·0–10·9%	11·0 + %
Pimpinio Dooen	Tarranyurk Arkona Serviceton Lillimur Kaniva Salisbury Klata Gerang Gerung Dimboola Wail Horsham Vectis Natimuk Jung Coromby	Yanac Lorquon Jeparit Ellam Antwerp Nhill Tarranginnie Miram Batchica Sheep Hills Nullan Minyip Murtoa Lubeck Jackson Burrum Bolangum St. Arnaud	Netherby Detpa Brim Lah Warrack-nabeal Banyena Marnoo Litchfield Donald Swanwater Sutherland Wycheproof Charlton Willaura	Morton Plains Watchem Massey Westmere Glenloth
District % 4·5 ..	22·1	34·7	32·0	6·7
State % 2.2	11·0	17·2	15·8	3·3

The baking tests were made under standard conditions and both loaf volume and percentage score are shown in the table. The best loaf of the series is credited with 100 per cent., so that scores should only be compared within this series. The scores, with minor exceptions, closely follow the protein content; this is in accord with results of previous seasons. However the score of 79 per cent for the 9–9·9 per cent. Wimmera sample is difficult to explain unless the assumption is made that this sample contained a larger percentage of the variety Diadem than did the other Wimmera samples.

The North-Eastern samples were somewhat better than the other districts and the Wimmera must be placed last on account of the large percentage of the crop coming into the low protein fraction.

TABLE 6.—MALLEE ELEVATORS.

(*Protein Content.*)

9·0–9·9%	10·0–10·9%	11·0–11·9%	12·0 + %
Carina Cowangie Tempy Birchip Pullut Rainbow Albacutya	Rosebery Beulah Galaquil Yaapeet Sea Lake Chinkapook Karawinna Panitya Tutye Murrayville Linga Underbool Walpeup Galah Ouyen Speed Gama Lascelles Hopetoun	Werrimull Patchewollock Woomelang Watchupga Curyo Manangatang Waitchie Cannie Nyah West Pira Nyarrin Boigbeat	Kinnabulla Berriwillock Culgoa Warne Nullawil Dumosa Chillingollah Gowanford Ultima Meatlan Lalbert Quambatook Gredgwin Barraport Piangil
District % 13·3	40·6	19·5	26·6
State % 4·0..	12·0	5·8	8·0

The baking results, taken as a whole, are neither as bad as some commercial bread would lead one to assume, nor as good as is possible. There are many difficulties involved in improving wheat quality and many of the gains obtained by introducing new varieties are being nullified by the rapid extension of the area sown to Quadrat. The immediate future depends upon varieties such as Pinnacle and Diadem, but ultimately, breeding and introduction of varieties much higher in baking quality than any at present being sown in Victoria must be considered.

TABLE 7.—NORTHERN ELEVATORS.

(*Protein Content.*)

9·0–9·9%	10·0–10·9%	11·0–11·9%	12·0–12·9%
Wedderburn Shelbourne	Bridgewater Raywood Goornong Colbinabbin	Tandarra Rochester Hunter Elmore	Buckrabanyule Barrakee Boort Wychitella Mitiamo
District % 12·9	31·5	27·8	27·8
State % 1·1..	2·7	2·3	2·3

TABLE 8.—NORTH-EASTERN

(*Protein Content.*)

9·0–9·9%	10·0–10·9%	11·0–11·9%	12·0–12·9%
Pine Lodge Cosgrove Devenish Goorambat	Yarrawonga St. James Yabba North Dookie	Picola Nathalia Cobram Wunghnu Tallygaroopna Katamatite Youanmite Tungamah Rutherglen	Waaia Katunga Numurkah Telford
District % 25·4	20·0	40·4	14·2
State % 3·2..	2·5	5·1	1·5

SUMMARY

The protein content of Victorian wheat, determined on representative samples taken from grain elevators throughout the State, is considered in relation to the quantity of wheat produced and the main wheat growing areas.

The protein content of this season's wheat is slightly higher than last year's and the baking quality is correspondingly improved. Baking quality was found to be correlated with protein content.

The increasingly large areas being sown to Quadrat must be viewed with concern because of the possible reduction in the baking quality of Victorian wheat. Of particular interest in this regard is the Wimmera, where Quadrat represents 61 per cent. of the total wheat area and where the lower inherent quality of this variety is coupled with the general low protein level of the district.

Acknowledgment

Acknowledgment is made to officers of the Grain Elevators Board who forwarded samples throughout the harvest; to Mr. G. Duncan, who conducted most of the protein analyses and assisted in their interpretation, and to the Grain Elevators Board for permission to publish the information contained in this report.

TABLE 9.—ANALYTICAL RESULTS.

District.	Wimmera.				Mallee.				Northern.			North-Eastern.			
Wheat protein (range) per cent.	7·0–8·9.	9·0–9·9.	10·0–10·9.	11·0–12·9.	9·0–9·9.	10·0–10·9.	11·0–11·9.	12·0–13·9.	8·0–10·9.	11·0–11·9.	12·0–12·9.	9·0–9·9.	10·0–10·9.	11 0–11·9.	12·0–12·9.
Wheat protein per cent. ..	8·4	9·5	10·2	11·8	9·6	10·4	11·3	12·6	10·4	11·4	12·2	9·7	10·6	11·6	12·2
Pelshenke figure, minutes ..	36	33	35	41	32	35	33	33	33	35	41	39	39	38	35
Flour protein, per cent. ..	7·2	8·0	9·1	10·3	8·5	9·2	10·3	11·4	9·0	10·2	11·0	8·6	9·5	10·4	10·8
Wet gluten, per cent. ..	21·4	25·1	28·0	34·1	28·0	31·5	34·5	37·9	29·3	35·1	37·4	28·5	31·5	33·8	35·3
Dry gluten, per cent. ..	7·1	8·3	9·6	11·5	9·2	10·0	11·4	12·3	9·5	10·3	11·6	9·5	10·2	11·3	11·3
Water absorption (Farinograph) per cent. ..	52·0	54·8	56·8	59·0	57·0	58·4	60·0	60·8	57·0	58·6	59·0	56·8	58·2	59·0	59·0
"E" figure (Farinograph) minutes	3·5	3·0	3·0	4·5	3·5	3·5	3·5	3·5	3·0	2·5	3·0	5·0	4·0	3·5	2·5
Valorimeter number (Farinograph)	30	32	30	38	34	34	36	34	30	30	32	40	38	32	32
Maltose figure (mgms. maltose per 10 grms. flour) ..	76	71	80	80	101	101	90	96	85	85	80	116	71	101	96
Loaf volume ccs.—															
Malt, phosphate procedure	540	570	515	545	525	510	515	520	565	560	605	540	550	570	560
Malt, phosphate, bromate procedure	525	570	510	600	540	575	630	630	570	565	645	545	545	660	660
Loaf score, per cent. (best loaf = 100)	64	79	68	90	72	85	95	98	79	79	100	77	79	100	100

Burnley Egg-Laying Competition

Results of Winter Test

By Martin D. Hall, Poultry Expert

THE thirty-ninth egg-laying competition for fowls, conducted by the Department of Agriculture at the School of Primary Agriculture and Horticulture, Burnley, commenced on the 1st April, 1949, and will continue until the 2nd March, 1950, a period of 48 weeks.

The Winter Test, conducted in conjunction with this competition, included the first four months (122 days) of the annual test, and concluded on 31st July. This test is held each year to give prominence to birds that lay well during the period when eggs are scarce and prices high. It is considered that egg production on commercial poultry farms can be improved by breeding from birds that have laid well during the autumn and winter months, and those that lay consistently during that period usually continue to do so at other times of the year.

Birds used for breeding should conform to the standard of the breed for size, colour and body conformation. They should also have laid a large number of first-grade eggs of normal shape and good-quality shell texture. It is well, however, to bear in mind that selection plays an important part in all systems of breeding.

Certificates are awarded for the greatest number of first-grade eggs laid by the three leading birds in all classes, provided a bird lays a minimum of 60 first-grade eggs or more. It is interesting to note that 68·6 per cent. of all the birds in the competition laid 60 eggs or more, during the 122 days of the test. During the first two months a first-grade egg must weigh not less than $1\frac{3}{4}$ oz., and thereafter not less than 2 oz.

The Australorps (wet-mash) set a high standard. Nine birds laid 100 or more first-grade eggs, and twenty-one laid 90 or more first-grade eggs.

The White Leghorns in the wet-mash section also registered excellent scores, seven birds laying 100 or more first-grade eggs.

The Rhode Island Reds have maintained the reputation built up over the last few years, and in this test five birds laid 100 or more first-grade eggs.

Scores in the different breeds were very even and quite a number of birds tied for the various prizes.

A creditable performance was recorded by two of Mr. E. A. Head's birds, as both obtained prizes in Class 4 with only one egg difference in their scores. Mr. W. Cocking also gained first and second prizes in Class 5.

INDIVIDUAL BIRDS—SINGLE TEST

In the class for Australorps fed on wet-mash, Mr. J. A. Broadbent and Mr. E. A. Head obtained equal-first prizes with birds that laid 111 first-grade eggs. Equal-third prizes were awarded to Mr. H. O. Stehn and Mr. E. A. Head, whose birds laid 110 eggs each.

In the White Leghorn class fed on wet-mash, equal-first prizes were awarded to Mr. S. G. McPhee and Mr. A. J. Waugh, both of whose birds laid 108 first-grade eggs. Mr. L. J. Jackson gained third prize with a bird that laid 104 eggs.

First prize in the class for White Leghorns, dry-mash, was awarded to Mr. W. H. Clements, whose bird laid 102 first-grade eggs. Molson's White Leghorn Stud gained second prize with a bird that laid 99 eggs, and third prize went to Mr. S. G. Moran, whose bird laid 93 eggs.

Mr. J. Fellows gained first prize in the Rhode Island Red class with a bird that laid 102 first-grade eggs, and second prize was shared by Mr. J. R. Armstrong, Mr. C. E. Buckley and Grenville Stud Poultry Farm, whose birds each laid 101 eggs.

In the class for light breeds other than White Leghorns (wet-mash) first prize was

awarded to "Glenyuille" (H. D. Stewart) whose Legbar laid 81 first-grade eggs. Mr. W. L. Marr's Ancona won second prize with a score of 74 eggs, and Carlella Poultry Farm gained third prize with a Brown Leghorn that laid 71 eggs.

First and second prizes in the class for heavy breeds other than Australorps and Rhode Island Reds (wet-mash) were awarded to Mr. W. Cocking, whose birds laid 91 and 82 first-grade eggs respectively, while Mr. J. Lang's Langshan gained third prize with a score of 81 eggs.

WINTER TEST PRIZE LIST, 1949-50 COMPETITION

INDIVIDUAL BIRDS—SINGLE TEST

Class 4.—Australorps—Wet Mash.

Pen No.	Name and Address.	Total Eggs.	Under weight.	First Grade Eggs.
	EQUAL FIRST PRIZE—CHAMPION CERTIFICATE.			
6	J. A. Broadbent, Lake-road, Walls End, N.S.W.	111	..	111
	EQUAL FIRST PRIZE—CHAMPION CERTIFICATE.			
70	E. A. Head, 38 Serrell-street, East Malvern	112	1	111
	EQUAL THIRD PRIZE—GOVERNMENT CERTIFICATE.			
51	H. O. Stehn, 41 Cornell-street, Burwood	110	..	110
	EQUAL THIRD PRIZE—GOVERNMENT CERTIFICATE.			
69	E. A. Head, 38 Serrell-street, East Malvern	110	..	110

Class 1.—White Leghorns—Wet Mash.

	EQUAL FIRST PRIZE—CHAMPION CERTIFICATE.			
186	S. G. McPhee, 27 Albert-street, Kerang	108	..	108
	EQUAL FIRST PRIZE—CHAMPION CERTIFICATE.			
213	A. J. Waugh, Helms-road, Kangaroo Flat	108	..	108
	THIRD PRIZE—GOVERNMENT CERTIFICATE.			
163	L. J. Jackson, 241 Tooronga-road, Glen Iris	108	4	104

Class 2.—White Leghorns—Dry Mash.

	FIRST PRIZE—CHAMPION CERTIFICATE.			
221	W. H. Clements, 7 Crown-road, Ivanhoe	104	2	102
	SECOND PRIZE—GOVERNMENT CERTIFICATE.			
230	Molson's White Leghorn Stud (G. B. Durkin), 188 Surrey-road, Blackburn	99	..	99
	THIRD PRIZE—GOVERNMENT CERTIFICATE.			
231	S. G. Moran, Glenburnie-road, Mitcham	93	..	93

Class 3.—Light Breeds, other than White Leghorns—Wet Mash.

	FIRST PRIZE—CHAMPION CERTIFICATE.			
122	"Glenyuille," (H. D. Stewart), Panmure (Legbar)	81	..	81
	SECOND PRIZE—GOVERNMENT CERTIFICATE.			
118	W. L. Marr (Marr and Son), 53 Garland-road, Narenburn, N.S.W. (Ancona)	74	..	74
	THIRD PRIZE—GOVERNMENT CERTIFICATE.			
113	Carlella Poultry Farm (J. W. Stoneman), Campbell-road, Briar Hill (Brown Leghorn)	71	..	71

Class 5.—Rhode Island Reds—Wet Mash.

	FIRST PRIZE—CHAMPION CERTIFICATE.			
88	J. Fellows, "The Rest," Yan Yean-road, Plenty	102	..	102
	EQUAL SECOND PRIZE—GOVERNMENT CERTIFICATE.			
79	J. R. Armstrong, 657 Bell-street, West Preston	102	1	101
	EQUAL SECOND PRIZE—GOVERNMENT CERTIFICATE.			
84	C. E. Buckley, 7 Mary-street, Werribee	103	2	101
	EQUAL SECOND PRIZE—GOVERNMENT CERTIFICATE.			
91	Grenville Stud Poultry Farm (G. W. Grenville), Springvale-road, Springvale	101	..	101

Class 5.—All Heavy Breeds, other than Australorps and Rhode Island Reds—Wet Mash.

	FIRST PRIZE—CHAMPION CERTIFICATE.			
72	W. Cocking, Kilmore East (Light Sussex)	91	..	91
	SECOND PRIZE—GOVERNMENT CERTIFICATE.			
71	W. Cocking, Kilmore East (Light Sussex)	82	..	82
	THIRD PRIZE—GOVERNMENT CERTIFICATE.			
74	J. Lang, 46 Dundas-street, Thornbury (Langshan)	81	..	81

LIVE STOCK NOTES

Compiled by A. C. T. HEWITT, M.Agr.Sc.,
Live Stock Science Officer

VICTORIAN MEAT PRODUCTION

THE amount of meat produced in Victoria last year was 270,000 tons, a quantity slightly above the average annual production of 265,000 tons over the past 15 years. Production averaged 275,000 tons from 1935 to 1939, 280,000 tons from 1940 to 1944, and 240,000 tons from 1944 to 1949. Production in each of the past 15 years is set out in the table.

VICTORIAN MEAT PRODUCTION, 1935–49.

Year.	Tons.	Year.	Tons.	Year.	Tons.
	000's.		000's.		000's.
1934/35..	249	1939/40	247	1944/45	275
1935/36..	269	1940/41	272	1945/46	185
1936/37..	289	1941/42	289	1946/47	232
1937/38..	292	1942/43	297	1947/48	238
1938/39..	278	1943/44	360	1948/49	270
Average 5 years	275	Average 5 years	280	Average 5 years	240

The big increase in meat production in 1942–43 and 1943–44 was largely brought about by farmers reducing their herds and flocks in the early stages of the big drought, whereas the low production in 1945–46 was due to stock losses in the drought and to graziers holding stock to build up their herd and flock numbers again.

Slaughterings of the different classes of animals and meat production last year, the previous year, and average figures over the past 15 years are given in the table hereunder.

In June of this year slaughterings of all classes of stock were much higher than in June last year. With increased numbers of all classes of stock except pigs being carried in Victoria, meat production for 1949–50 is expected to increase considerably.

—	1948/49.	1947/48.	15 year Average 1935/49.
	000's.	000's.	000's.
Beef and Veal.			
Slaughterings—Numbers of cattle			
Bullocks	178	180	173
Cows	249	227	207
Young cattle	76	56	71
Calves	321	286	315
Production in tons.. ..	112	105	109
Mutton.			
Slaughterings—			
Sheep Numbers	3,147	2,642	3,555
Production in tons.. ..	60	51	72
Lamb.			
Slaughterings—			
Lamb Numbers	3,397	3,600	4,078
Production in tons.. ..	52	55	60
Pig Meats.			
Slaughterings—			
Pig Numbers	371	377	445
Production in tons.. ..	26	27	*

* Figure not available.

[A.C.T.H.]

YOUNG CALVES DO NOT THRIVE ON VEGETABLE FATS

The value of vegetable fats as a substitute for the butterfat in skim milk fed to calves from two to three days old was tested by Dr. W. E. Petersen, Professor of Dairy Husbandry at the Minnesota University in U.S.A. The milk was separated and divided

into halves; butterfat was added to one half and vegetable fats to the other, to bring the milk up to a 3·0 per cent. fat content in each case. Both milks received exactly the same treatment except for the different kinds of fat emulsified in them.

Reactions of the calves receiving the two milks was marked. The group receiving the milk to which butterfat had been added grew and developed as though the milk had come straight from the cow. The calves in the vegetable fats group developed normally for a week or two and then began to fall away in condition. Few of these calves lived more than 60 days. If more vegetable fats were added they did not live even that long.

The addition to the vegetable fats of the various vitamins which milk for calves should contain, had temporary effects which benefited the calves for an additional ten days, but after this period they again fell away in condition. [A.C.T.H.]

INFRA-RED LAMPS FOR CHICK BROODING

Infra-red lamps are used to a limited extent for chick brooding and some excellent results have been claimed. The brooders are simple and unusual in design as they dispense with overhead covers. This feature has two distinct advantages as the chicks obtain ample fresh air and are under observation all the time during the brooding period.

The brooder consists of a triangular frame made of wood or metal with sides 32 inches long and a lamp-holder attached to each corner. Two subsidiary switches are used, each controlling a single lamp so that, in conjunction with the main outlet switch, each of the three lamps may be controlled. Three-core flex is attached to the frame in such a manner as to comply with the regulations.

The frame is suspended by three wires, one from the centre of each side taken to a central point and from there by a single cable to an overhead pulley attached to a roof rafter. This simple fixture allows the brooder to be suspended at the required height from the floor—usually 12 to 16 inches.

A circular iron fence about 12 inches high and 7 feet in diameter is placed on the floor with the brooder frame suspended above the centre. Water and feeding troughs are placed inside the fence.

To commence, the day-old chicks are placed under the brooder which is suspended approximately 12 inches from the floor. The three lamps are used night and day for the first seven days, but after the third day the brooder is raised to a height of 16 inches. From then on until the 13th day one lamp only is used during the day and two at night. Any variation during the remainder of the brooding period depends on the weather conditions. On the fourth day, the fence is extended a little and progressively until the tenth day, when the chicks are allowed the full run of the pen.

The cost of operation must be considered as each of the 250-watt lamps uses one-quarter of a kilowatt of power each hour and electric power costs from 1d. to 2¼d. per kilowatt hour. Intending users should compare results and costs with regular-type brooders before making a complete change-over to infra-red lamps. The brooder is designed for 150 to 200 chicks.

The fact that chicks can be successfully reared without the use of hovers is of great importance as most troubles develop under hovers. Unless the hovers are regularly inspected the troubles usually reach advanced stages before being noticed. With infra-red brooding, it is possible to see the chicks all the time, and this factor in conjunction with the absence of impure, humid air would appear to outweigh the higher cost of operation. If stronger and better chicks are obtained, the system might receive consideration.

Arrangements are being made at the State Research Farm, Werribee, to carry out tests with this system of brooding.

[M. D. Hall, Poultry Expert.]

BEE KEEPING

During the warm days, colonies can be examined and any found short of stores should be assisted by feeding sugar syrup, honey or combs containing stores. Best results in brood-rearing will be obtained from prolific queens, if a surplus of not less than 10 or 12 lb. of honey is available for the colony to work on. Colonies forced to live on scant stores are not so profitable as colonies that have had ample stores for

brood-rearing. 10 lb. of stimulative feed given at the right time will repay its cost handsomely, when the honey flow arrives.

A check should be made now to see that all colonies have laying queens. Queenless colonies can be united to a normal colony, as it is still too early to secure queens from suppliers. To carry out the operation select a normal colony of about the same strength as the queenless one and remove the cover. Place a newspaper over the cluster of bees. Then remove the bottom board from the queenless hive and place the hive on top of the newspaper over the normal hive. Carry out the operation towards evening. The two clusters will gnaw through the paper and unite without fighting, but if fighting should take place smoke the hive entrance vigorously for a few minutes.

Colonies required to rear drones for mating purposes should have drone-comb available and given an abundance of stores to allow them to breed freely.

Hives and materials should be prepared to cope with swarming. The swarming impulse can be more easily handled, and controlled if preparation is made in advance, and the apiarist is able to cope with all the requirements of the rapidly expanding bee population.

[W. A. Collins, Senior Apiary Inspector.]

MILK FEVER AND GRASS TETANY

Research work has shown that milk fever is associated with a lowering of the calcium content of the blood serum, while in many cases of grass tetany there is a decrease in the magnesium content of the blood.

The logical result of this knowledge was to treat affected cows with a view to restoring normal levels by the administration of suitable mineral salts—calcium borogluconate for milk fever and magnesium sulphate for grass tetany. Although the measure of success following such treatment is good, some cows, although responding to a certain degree, fail to rise, and many remain lying down for long periods in spite of repeated or combined treatment.

Recent work has shown that the inorganic phosphate content of the blood stream also plays a part in this complex condition. It is suggested therefore that the cow which does not respond quickly and completely to the calcium and/or magnesium therapy, but which sits up and is apparently normal, should be given phosphates. The initial dose per mouth is three (3) ounces of acid sodium phosphate in ½ pint of water, followed by ½ ounce of acid sodium phosphate three times daily.

It is also suggested that, as a precautionary measure, cows subject to attacks of milk fever or grass tetany, or grazing under conditions which might be expected to cause either complaint, should be given one tablespoonful of bone flour twice daily in a small feed for at least six weeks prior to the calving.

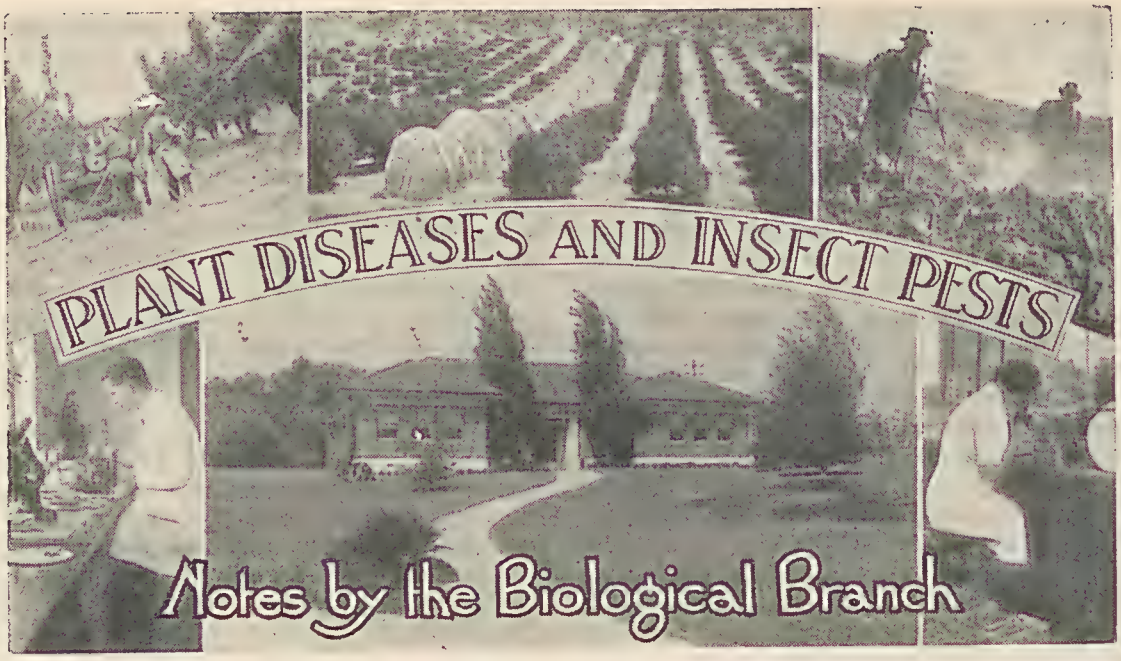
[A. R. Grayson, B.V.Sc., Senior Veterinary Officer.]

FOOD PARCELS FOR BRITAIN

The Department of Agriculture this year is again sponsoring a Christmas gift scheme under which parcels of foodstuffs may be sent by Australian donors to relatives and friends in Great Britain. Under this arrangement a standard food parcel will be packed in Melbourne and forwarded by parcels-post direct to recipients in the United Kingdom.

Contents of parcel are as follows :—16 oz. tin Honey ; 16 oz. tin Casserole Steak; 12 oz. tin Luncheon Beef Loaf ; 12 oz. tin Full-Cream Powdered Milk ; 16 oz. tin Beef Dripping ; 12 oz. tin Cheese ; 16 oz. packet Sultanas ; 12 oz. packet Currants ; 12 oz. tin Barley Sugar. These selected items of foodstuffs are still needed in Britain, and should be much appreciated by the recipients of the gifts. The cost of the parcel including postage is 20/–.

Orders will be accepted at donors' own risk for dispatch to any address in England Scotland, Wales and Northern Ireland. Orders for Eire cannot be accepted because of the heavy customs duty in that country. Donors of gifts should forward their orders together with the necessary remittance to the Director of Agriculture, Treasury Gardens, Melbourne, C.2.



HALO BLIGHT OF BEANS

Halo Blight of beans is a very serious disease causing extensive damage to commercial and home garden French bean crops in Victoria. The disease is caused by a bacterial organism—*Pseudomonas medicaginis var. phaseolicola.*

The disease attacks leaves, pods, and stems of the plant causing local lesions and sometimes systemic infection and death of the plant.

On the leaf, the first symptom is usually the appearance of small, brown, water-soaked spots on the underside of the leaf or leaflets. The spots are usually straight-sided and bounded by the small veinlets. As the disease develops the spots enlarge and coalesce, and later, the lesioned area may die and fall away from the body of the leaf.

A greenish-yellow, halo-like zone develops around the water-soaked lesions at an early stage—hence the name Halo Blight. Sometimes the haloed zone may cover almost half the area of the leaf, even though the water-soaked focus may consist of a single minute spot. Often the water-soaked spots and halo first appear close to the margin and near the tip of the leaf. It is considered that the yellow-green halo area is caused by toxins liberated by the bacteria.

The symptoms on the pods commence as small circular lesions giving the appearance of drops of candle grease. Because of this symptom, the name "Grease Spot Disease" has sometimes been given to the disease. The spots frequently first appear at the distal tip of the pod. As the lesions enlarge a silvery exudate may often be seen at the surface and frequently, in the advanced stage, the rim of the lesion takes on a brick-red appearance. In very severe pod infection, the seeds may become stained by bacterial action.

On the stem, the symptoms may first appear as reddish streaks running longitudinally along the stem. The surface of the stem often splits and a bacterial exudate may develop.

Methods of spread

The disease is carried in the seed and the most common form of spread is through the sowing of seed which has been grown from a crop infected with the disease.

No effective form of seed sterilization has yet been developed to treat diseased seed on a commercial scale, as the organism is carried beneath the seed coat and any sterilizing material which can penetrate so deeply into the seed will usually also cause permanent injury to the embryo. A plant grown from diseased seed usually exhibits

disease symptoms early in the season, sometimes even in the cotyledonary stage. Often the young leaves are almost completely covered by the halo zone and the seedlings then rapidly wither and die. A primarily

Bean pods showing "grease-spot" halo blight lesions.

infected seedling can usually be picked out quite readily by eye in a field as the yellow-zoned appearance of the leaves stands out in marked contrast to the remainder of the crop.

The disease can spread through a crop very rapidly. The grease-spot lesions under humid conditions exude a mass of bacteria which can be distributed through the crop in many different ways. Rain, accompanied by wind, is the most dangerous form of spread as in a few hours bacteria may be splashed from plant to plant throughout the crop and cause complete devastation. It needs only two or three primarily infected plants in a crop to provide the initial focus of a wide scale infection under suitable environmental conditions. Another common form of spread is by human or animal agency, or implements. For example, a rabbit or dog running through a crop may, on a moist day, carry bacteria from plant to plant en route.

Control

The following measures are recommended for the control of Halo Blight :—

1. *Use of Resistant Varieties.*—There is not available at present any commercial French bean variety which is immune to the Halo Blight disease, but there are varieties which possess a considerable degree of resistance.

The variety, Hawkesbury Wonder, bred in N.S.W., is much more resistant than the commonly-grown Brown Beauty, and, for this reason, is now being much more widely used by commercial growers. The Burnley type, Canadian Wonder, is, perhaps, the most resistant of all commercial varieties, but is not popular because of its relatively poor carrying quality. The original type Canadian Wonder from which the Burnley selection was made was an exceedingly high-quality market bean, but, because of its marked susceptibility to Halo Blight, is now only rarely grown in Victoria.

Several promising varieties of French beans carrying some field resistance to Halo Blight have recently been produced by Australian breeders, but it will be some time before sufficient quantities are available for commercial distribution. The climbing beans as a group are generally very resistant to Halo Blight, as are many of the small navy bean types, notably Great Northern and Robust.

2. *Use of Clean Seed.*—The most effective method at present available to Victorian growers to control Halo Blight is to sow clean seed, i.e., seed grown from a crop, which, in the previous growing season, showed no sign of the disease.

In order to assist growers to procure seed of this quality, the Victorian Department of Agriculture operates a French Bean Seed Certification Scheme. Under this scheme, French bean seed crops are submitted to the Department for certification, and, if, after a number of field inspections during the growing season, no evidence of Halo Blight and certain other diseases are observed, the seed harvested is sealed and tagged as "Victorian Certified French Bean Seed".

3. *Clean Farming Practice.*—Constant vigilance should be maintained to ensure that disease is not introduced to a potentially clean crop through the agency of farm machinery. This can happen in many ways. The drill used for seeding the crop may not have been thoroughly cleaned out before use and may be harbouring an odd diseased seed from the previous year. (The bacterium can remain alive in seed for some years.) Use of a cultivation implement fresh from a crop known to be diseased is also dangerous unless the implement is thoroughly disinfected with a bactericidal agent before using.

4. *Rogueing of Diseased Plants.*—As stated earlier in these notes, a crop may become severely infected with Halo Blight under particular weather conditions even though the original number of diseased plants in the crop is very small. The practice of "rogueing" of diseased plants is, therefore, particularly advisable and is frequently most effective in preventing spread of the disease. A careful watch should be kept for diseased plants whenever the crop is being tended and the affected plant immediately pulled out. It is advisable to remove plants in a circle of 3 to 4 yards in diameter around the diseased plant in case the plants in immediate contact may have already contracted the disease at the time of rogueing, yet have not developed obvious symptoms. In a crop with numerous foci of infection rogueing is usually quite ineffective in preventing spread.

Halo Blight symptoms often become markedly discernible at, or just prior to, flowering, and a special point of inspecting the crop for diseased plants at this stage should be made. A first inspection at first true-leaf stage is also advisable as a heavily-infected seedling grown from diseased seed will be readily distinguishable at this stage, and its removal may prevent serious loss to the crop.

5. *Crop Rotation.*—It is generally agreed that the Halo Blight organism cannot live independently in the soil for a period longer than three to four months. However, if one bean crop follows closely upon another which has shown the disease, there is a danger of infection from self-sown seed from the previously diseased crop and from organisms which may remain alive on odd bits of bean plant refuse about the field. It is, therefore, wise to avoid following a diseased crop by another bean crop for at least two years. In this way, also, build up of other diseases specific to beans is prevented.

6. *Isolation.*—Care should be taken to avoid sowing a crop of beans immediately adjacent to an existing infected crop. When a neighbouring crop is diseased, a gap of at least 15 chains should be allowed before sowing another bean crop, and, if possible, a tall and thick-growing crop such as maize, should be planted between the two bean crops to act as a buffer.

Where large areas of beans are being sown in the one paddock, it is advisable to subdivide the area with maize strips 6 to 8 feet wide. By this means an outbreak of disease in a limited area may be prevented from spreading to other sections of the crop.

Typical leaf lesions due to halo blight of beans

INSECT PESTS

RED-LEGGED EARTH MITE AND PEA MITE

The Red-legged Earth Mite *Halotydeus destructor* and the Pea Mite *Penthaleus major* are two closely allied species of mites and their identity is often confused.

The pea mite has a purplish blue body with a red spot on its back, and bright red legs, whereas the red-legged earth mite has a velvety-black body and dark-red legs. Generally these two mites attack the same range of garden and pasture plants. Vegetables most susceptible are pea, lettuce, silverbeet, carrot, spinach and potato.

In the flower garden, calendulas, snapdragons, violets, stocks and numerous other species are often affected. With field crops, those having succulent two-leafed seedlings are most susceptible to injury; these include flax, chicory, rape and other crucifers.

Cereals are less frequently attacked, although oats are often severely damaged.

In pastures, seedling clovers and trefoils are often damaged so severely as to cause partial or even complete failure of their constituents. The red-legged earth mite damages subterranean clover seedlings severely, particularly in a dry autumn when growth is slow.

Weeds, chiefly capeweed, often carry a heavy population of these mites, which are primarily pests of seedlings in autumn, winter and early spring. They are present in most gardens from April to September.

For their early development the mites require moist conditions and appear in the garden usually after the first substantial autumn rains. They continue to breed freely during the winter until checked by hot dry weather in the following spring.

Eggs retained in the body of the female when she dies are resistant to the hot dry spells experienced during summer. The mites feed in the early morning and late afternoon and, when disturbed, they disperse rapidly over the plants or drop to the soil below.

Severe damage to the leaves of plants is caused by the mouth parts piercing the tissues and withdrawing sap and chlorophyll, frequently giving to the plant a wilted appearance. Extensive feeding of these mites causes the leaf to have a characteristic silvery appearance, followed by browning of the tips and margins. In less severe cases, small white areas appear on the leaf tissue.

Seedling plants severely infested may not recover from the attack, but remain stunted in growth and subsequently die.

Control measures

Measures for control of these pests should not be directed solely at the infested plants. The soil underneath the plants where the mites shelter should also receive attention.

The following treatments are recommended where mites are already present:—

1. Dust affected plants and the soil underneath with 2 per cent. DDT dust. For large areas it may be necessary to treat only the headlands.

2. Spray with the following mixture—1 oz. of 50 per cent. DDT wettable powder or 3 oz. of 20 per cent. DDT emulsion in three gallons of water. Best results are obtained by spraying in warm sunny weather during the warmest part of the day.

3. For field crops a mixture of 1 part of carbolic powder and 4 parts of superphosphate or lime is satisfactory. Apply this mixture at the rate of 1½ cwt. per acre through a manure spreader preferably after autumn rains.

If control is to be effective, seedling beds and surrounding areas must be kept free from weeds, especially capeweed, which is a favourite host for these mites. A creosote barrier placed around the garden plot will act as a repellent to mites invading the area from adjacent infested areas. This may be applied through two 2-inch nail holes about ⅛ inch apart in the bottom of a gallon tin carried at a fast walking pace. One gallon of creosote will form a narrow barrier about 10 chains long on weed-free firm soil.

BULB MITE

The bulb mite *Rhizoglyphus echinopus* (*hyacinthe*) is a serious pest of bulbs and tubers. Bulbs of hyacinth, iris, tulip, lilium and narcissus are commonly attacked. Tubers of potatoes and dahlias are the most susceptible to injury. The adult mites, which are extremely small in size and pale pinkish in colour, are world-wide in distribution. There is some doubt as to whether or not

these mites can initiate attack on a perfectly sound bulb, some investigators regarding their presence as secondary to mechanical injury of the tissue, or to bulb diseases. However, with hyacinths at least, the attack appears to be primary.

Control is made difficult by the fact that the mites live and feed on the outside of the bulb, and also can thrive between the bulb scales. Here they feed and lay their eggs in the bulb's interior where it is most difficult to reach them.

Control

Bulbs which are heavily infested, and are thus soft and decomposing, can be separated from apparently sound bulbs by visual inspection These affected bulbs should be destroyed immediately by burning. Sound bulbs can be subjected to either of the following treatments :—

1. Immerse bulbs for ten minutes in a solution containing 1 part of nicotine sulphate in 400 parts of water heated to 122°F.

2. Immerse the infested bulbs in water maintained at 110–111·5°F. for three hours. Sound healthy bulbs in which root growth has not started will not be injured by this treatment.

When lifting and storing bulbs, discard any bulb that has been cut and damaged, as these specimens are readily attacked by pests and disease.

CALIFORNIAN MITE *Tenuipalpus californicus* Banks

The association of Californian Mite with vines and citrus has been known for a long time in America where it is not regarded as a serious pest.

In Australia it has come under notice as a pest of vines and citrus causing shedding of berries and scarring of vine canes near the base. Certain types of brown rind markings of the summer lemon crops also are attributed to these mites.

The adult mite is much smaller than red spider or bryobia mite. It is bright red, very flat, and its movements are slow. The eggs are red and are laid in clusters of a few to nine or ten in depressions on the fruit surface.

AUSTRALIAN VINE MITE *Tenuipalpus australis* Tucker

The Vine Mite is similar to the Californian mite and has been found on vines, citrus and ornamental shrubs. From their effect on grapes, these pests are often known as bunch mites.

Control

On citrus, white oil spraying at 1 in 40 as for scale insects provides a satisfactory control, but may be applied with advantage rather earlier than for red scale, namely early in February. For vines apply lime sulphur using 1 gallon in ten gallons of water and spray just before bud-burst. If damage to vines has been severe, follow this with colloidal sulphur when the shoots are 9 to 12 inches long, using 2 lb. colloidal sulphur and 4 lb. of soap per 100 gallons of spray. The sulphur spray may be combined with early Bordeaux sprays, but omitting the soap which is unnecessary and even rather incompatible.

VINE LEAF BLISTER MITE *Eriophyes vitis*

The vine leaf blister mite is colourless and not visible to the naked eye. The adult mites live under the bud scales during winter and attack the very young leaves as they open, causing the characteristic blister-like swellings on the upper leaf surface, with excessive development of leaf hairs in the cavity of the blister on the lower surface of the leaf. Heavy infestation causes excessive deformation and stunting of leaf growth.

Control

A winter spray of lime sulphur 1 part to 10 of water is effective. Where frequent sulphur dusting for powdery mildew is practised, the mite usually is not in evidence. Treatment with commercial dusting sulphur 90 per cent. is satisfactory. This must contact the underside of the leaf. Liquid lime sulphur 1 part to 70 parts of water may be used when the shoots are 9 to 12 inches long.

Eriophyes tristriatus, the walnut-leaf blister mite produces similar blisters on walnut leaves and is controlled by the same treatment where this is practicable.

Control of Bovine Tuberculosis

By R. J. de C. Talbot, B.V.Sc., Superintendent of Live Stock

TUBERCULOSIS is a contagious disease which has a very wide distribution and effects man and many species of mammals and birds. It is characterised by the formation in various organs of the body of minute nodules or tubercles which contain the causal organism, the tubercle bacillus. The disease in its various forms has been known for many hundreds of years and even in the Middle Ages we find laws having reference to the destruction of infected animals and the prohibition of the use of their flesh.

The percentage of animals affected varies greatly in different countries but in most of them, with the possible exception of the United States of America and Denmark, its prevalence among cattle is high, particularly among dairy cattle. For instance, in Great Britain, it has been stated that 40 per cent. of all dairy cattle are affected and in some other European countries the incidence of the disease is undoubtedly high.

In Australia, due to the widespread nature of our cattle population, the percentage of affected animals is difficult to estimate. However, sufficient herds have been tested in Victoria to permit a fairly accurate estimate of the incidence of the disease to be made, and it is believed that about 3·5 per cent. of our dairy cattle are affected. It must be pointed out, however, that in certain herds the percentage of affected animals may be very much greater than this average figure, and in some herds the incidence of the disease, as revealed by the tuberculin test, has been found to be as high as 30, 40, 50, or even 80 per cent.

A conservative estimate of the annual wastage due to tuberculosis in Victoria would be £150,000 per annum as a direct loss to the industry.

Swine may also contract tuberculosis and in these animals the disease is usually of bovine origin. They become affected through eating the diseased organs of infected cattle or drinking whole or skimmed milk from tuberculous cows. Pigs may be affected with the avian or fowl type of tuberculosis.

METHODS OF INFECTION

Cattle usually become infected by inhaling or swallowing the organism which causes the disease. Cattle are most commonly infected by breathing air laden with the tubercle bacilli resulting in tuberculosis of the lungs and the glands connected with them.

The disease is usually of a chronic nature and may for a long time be confined to small areas of the lungs. In some cases, however, the infected areas increase in size until a large part of the lung becomes consolidated. From these areas the germs may be conveyed to other parts of the body where they set up new centres of infection. Some of the bacilli may be coughed up and swallowed and pass out in the faeces.

SYMPTOMS

The symptoms are not always very distinct, the onset being gradual, and frequently cattle may be extensively affected without showing any obvious signs. In more advanced cases the animal presents an unthrifty appearance and there is chronic coughing with troubled breathing and swelling of the glands about the head and neck. In addition to these glands there are others which may be affected such as those in front of the shoulder or flank, and above the udder. The udder itself may be affected, in which case tubercular nodules of various sizes are found scattered throughout the udder tissue.

No cure for tuberculosis in cattle is known and once a herd is affected it will remain so unless the disease is eradicated.

RELATION TO PUBLIC HEALTH

Although the type of bacillus which causes tuberculosis in cattle is somewhat different to that which causes the disease in man, it is possible for human beings to be infected with the bovine type. The susceptibility of humans to the bovine tubercle bacillus is greatest during the early years of life and many cases of tuberculosis in children are of bovine origin.

The transmission of tuberculosis from cattle to man is usually due to the consumption of infected milk and other dairy products and, as cows' milk plays a predominant role as an essential nutrient in the diet of children, it is imperative that every safeguard should be taken to ensure that milk is not only wholesome, but free from infection with the tubercle bacilli. From this point of view alone the elimination

of a disease in cattle which may cause serious illness and mortality in children, should receive every support.

Looked at either from the animal health or public health point of view, bovine tuberculosis is a serious problem and the question of its eradication is one of paramount importance. In the United States of America the problem has been attacked and most stock-owners are aware of the great success which has attended the American Bovine Tuberculosis Eradication Campaign.

As a result of public approval and support, funds were made available from State and Federal sources and in 1917 the campaign for the eradication of bovine tuberculosis was commenced. During that year, some 20,000 cattle were tested. By 1929 the number had increased to 11,000,000, and in 1935 25,000,000 were being tested. By 1941 the whole of the cattle in the United States had undergone the T.B. test, with the result that bovine tuberculosis is now practically non-existent in U.S.A.

ERADICATION DEPENDS ON TUBERCULIN TEST

Any plan for the eradication of bovine tuberculosis whether conducted on a large scale or in a single herd, must depend upon the tuberculin test. This test applied by trained veterinarians, has a remarkable degree of accuracy in indicating affected animals. The test, together with application of control measures based upon our knowledge of the disease, make possible the elimination of tuberculosis from a herd. It must be pointed out, however, that the mere testing of a herd and the removal of reactors does not immediately transform it into a tubercle-free herd. The time taken for the elimination of the disease from a herd varies with the initial degree of infection and the facilities for isolation and disinfection. Under typical farm conditions where the initial degree of infection is found to be about 10 per cent. it may take from 18 months to 2 years to eliminate the disease.

In Victoria, the number of herds being regularly tested has increased considerably during the last ten years. For the year ended 30th June, 1939, 11,000 cows were tested, whereas at 30th June, 1948, 147,000 cows in 3,200 herds were being regularly tested. The majority of herds being tested are those supplying milk to the Melbourne and metropolitan area and some 30 provincial cities and towns.

Last year 45,000 cattle were tested for the first time and the percentage of reactors was 2·6 per cent. In those herds which had been previously tested the percentage of reactors was 0·6 per cent. Of the herds being tested, 1,600 have been tested twice without any reactors, and 900 herds have passed one test without reactors.

Under the Department's Accredited Tubercle-free Herd Scheme some 65 herds in which there are 4,500 cows, have been accredited. Under this scheme a tubercle-free accredited herd of cattle is one in which the entire herd has passed two negative successive annual physical examinations and tuberculin tests, or upon disclosure of infection three semi-annual successive physical examinations and tuberculin tests applied by a State veterinarian or by a qualified registered veterinarian approved by the Chief Veterinary Inspector for that purpose. This scheme also provides that no animal may be introduced into a tubercle-free herd unless it has passed two tests with an interval of 90 days between the tests.

The majority of herds accredited under this scheme are stud herds and as most sales of stud cattle are conditional upon the animals passing the tuberculin test, or coming from an accredited herd, stud masters in their own interests should take the steps necessary to have their herds accredited.

As it becomes possible to increase the veterinary staff of the Department, it is intended to increase the number of herds being tested, and the time is not far distant when it will be possible to declare certain areas of the State as tuberculosis-free.

The complete eradication of tuberculosis from the Victorian dairy cattle, of which there are some 2,100,000 head is a task of some magnitude and for economical and other reasons, any scheme of this nature must be introduced gradually and be spread over a long period.

Tentative plans for the complete eradication of bovine tuberculosis have been drawn up. These envisage a programme of testing extending over twenty years, involving the application of millions of tests by a staff of more than twenty veterinary officers.

The job is an enormous one and will involve the expenditure of a large sum of money for administrative costs and compensation, but its adoption would undoubtedly, from all points of view, be sound policy.

Pest and Disease Control in the Farm Orchard

By G. W. Gayford, B.Agr.Sc., Senior Horticultural Instructor

Here are the main insect pests and diseases of fruits commonly grown in the home garden, listed in convenient, quick reference form, together with their symptoms and treatment. If the reader is uncertain as to what pest or disease is attacking his plants he is invited to send specimens to the Department of Agriculture for identification. It is well to remember that most sprays are preventive and, therefore, once the symptoms appear, it may not be possible to control the pest or disease. For effective spraying, a stirrup or bucket pump is required. For several trees, a knapsack pump is more efficient. Finally, thoroughness and correct timing are the essentials to success.

Insect Pest or Disease.	Fruit.	Symptoms.	Treatment.
1. All Deciduous Fruit Trees and Vines.			
Scale insects (Apple Mussel, San José, Vine Scale, &c.)	Deciduous fruit trees and vines	Small, round or oval caps attached to twigs and limbs of trees	Red oil, 2 pts./4 gals. or lime sulphur, 2⅔ pts./4 gals.—June–August
Red spider, Bryobia mite	Deciduous fruit trees and vines	Tiny red-legged, brown-bodied insects appear on leaves in summer. Clusters of red eggs under twigs	Red oil, 2 pts./4 gals. or lime sulphur, 2⅔ pts./4 gals.—June–August. For summer control, H.E.T.P. 1 tablespoon to 4 gals., two sprays 10 days apart
Lichens	Deciduous trees ..	Greenish-yellow scaly growths on trees, mainly in wetter districts	Lime sulphur 3¼ pts./4 gals. Tar distillate or D.N.C., 1 pt./4 gals. in winter
2. Pome Fruits—Apples, Pears, Quinces.			
Codling moth ..	Apples, pears, and quinces	Holes in fruit surrounded by brown granules	Lead arsenate powder, 2 oz. *plus* ½ cup (3 fl. oz.) DDT 20 per cent. emulsion; *or* lead arsenate *plus* 1½ oz. 50 per cent. DDT powder in 4 gals. water early November, early December, mid January, late February. N.B.—Also take precautions against mites as above
Light-brown apple moth	Apples and pears ..	Small, greenish-coloured grub which eats leaves and surface of fruit	Above programme for codling moth will give control. DDT alone is unsatisfactory
Black spot	Apples	Black spots on surface of leaves and fruit	Bordeaux mixture (Note A*) when buds are opening Lime Sulphur, 1 pt./4 gals. when 5 per cent. blossoms open Lime sulphur, ¾ pt./4 gals. when 80 per cent. petals have fallen. Later sprays lime sulphur, ⅓ pt./4 gals.

* See Note page 422.

Insect Pest or Disease.	Fruit.	Symptoms.	Treatment.
2. Pome Fruits—Apples, Pears, Quinces—*continued.*			
Black spot	Pears	Black spots on leaves and fruit	Bordeaux mixture (Note A*) at bud burst and when blossom buds separate in cluster. Half strength Bordeaux mixture at petal fall. Apply only first Bordeaux spray to Josephine and Winter Cole varieties During winter destroy old leaves lying around tree from previous seasons growth
Woolly aphis ..	Apples	Clusters of small black insects covered with white sticky threads	Normally controlled by parasitic wasp. When infestation severe use red oil, 2 pts./4 gals. of water or H.E.T.P., 2 tablespoons/4 gals. of water in winter. H.E.T.P., 1 tablespoon/4 gals. water in summer
Pear and cherry slug ..	Pears and quinces ..	Slimy slugs eat surface of leaf, leaving brown patches	Lead arsenate powder, 2 oz./4 gals. water or DDT, ¼ cup 20 per cent. emulsion/4 gals.
Leaf variegation ..	Apples	Mottled yellow patches on leaves	No control—does not affect productivity of trees
Pear leaf blister mite	Pears	Small, scattered, pale-greenish blisters on young leaves, later turning dark-brown or yellow	Lime sulphur, 3¼ pts./4 gals. Just before buds swell in late winter. This spray effective for pests in Group 1
3. Stone Fruits—Peaches, Nectarines, Apricots, Plums, Cherries, Almonds			
Green peach aphid and and black cherry aphid	Peach and cherry trees	Small green insects clustered thickly on new growth of peaches causing leaves to curl. Small brown and black insects on new growth of cherries	Tar distillate, or D.N.C. Winter Washes, 1 pt./4 gals. Before mid-July to kill eggs. For summer control, use DDT, ½ cup 20 per cent. emulsion/4 gals., or H.E.T.P., 1 tablespoon/4 gals.
Black peach aphid and other aphids on trees during spring and summer	Peach trees, &c. ..	Small black or green insects clustered on leaves of trees	Nicotine sulphate, 1 fl. oz./4 gals. plus 2 oz. soap, DDT or H.E.T.P. (see above) as soon as aphids are noticed in early spring
Shot hole or scab ..	Apricots, plums, almonds, and peaches	Small holes in leaves. Apricots covered with small round black scabs. Gum spots on peach twigs	Bordeaux mixture (see Note A*) (i) at "pink bud" stage in spring; and (ii) when leaves fall in autumn
Leaf curl	Peaches and nectarines	Leaves curl and thicken. Thickened part becomes red and covered with greyish powder	Bordeaux mixture (see Note A*) at "pink bud" stage

* See Note page 422.

Insect Pest or Disease.	Fruit.	Symptoms.	Treatment.
3. Stone Fruits—Peaches, Nectarines, Apricots, Plums, Cherries, Almonds—*continued.*			
Brown rot	All stone fruit ..	*Blossom blight.*—Flowers wilt, turn brown and become covered with brown powder *Fruit.*—Circular patch of soft brown rot which becomes covered with brown powder *Twigs.*—Brown decayed patches	Bordeaux mixture at "pink bud" stage (Note A*) *Cherries.*—Lime sulphur, ¼ pt./4 gals. water, fruit ½–½ grown *Peaches.*—½ lb. sulphur, ½ lb. limil plus ½ oz. spreader in 4 gals. water. Apply at monthly intervals from October *No* post-blossom sprays of sulphur or copper can be applied to apricots. Remove and destroy all infected fruit ("mummies") on ground or sticking in tree. Remove decayed twigs
Peach and prune rust	Peaches, plums, and prunes	Small yellow spots on upper surface of leaves. Raised brown pustules discharging spores on underside; circular green depressions in fruit	Treat as for brown rot on peaches
Pear and cherry slug	Cherries and plums ..	Slimy slugs eat surface of leaf, leaving brown patches	Lead arsenate powder, 2 oz./4 gals. water or DDT emulsion or powder
4. Citrus Fruits—Oranges, Lemons, &c.			
Scale insects (various)	Citrus	Red, brown, or black scales on skins, leaves, and fruit	White oil emulsion, ¾ pt./4 gals. (i) mid-December; and (ii) mid-March. May be combined with Bordeaux sprays but do not use oil immediately following the Bordeaux spray
Sooty mould ..	Citrus	Dense black powder on leaves and fruit	Associated with scale insects; use Bordeaux mixture (½ strength combined with oil spray for scale)
Bacterial pit ..	Lemons	Sunken black areas ½ to ¾-in. diameter in skin of fruit	Bordeaux mixture, ½ strength (Note A*) autumn and spring
Septoria Spot and anthracnose	Citrus	Small to large dark-brown spots in skin of fruit	Bordeaux mixture, ½ strength (Note A*) in autumn
Collar rot	Citrus	Bark of trunk near ground level dies, later dries out and splits. Usually accompanied by copious development of gum	Ensure good soil drainage. Cut away dead tissue with sharp knife, exposing tops of main roots if necessary. Paint area with Bordeaux paste (Note A*)
Mottle leaf (zinc deficiency)	Citrus	Leaf mottled, area along midrib and veins normal, remainder light yellow to white	Zinc sulphate, 6 oz. plus hydrated lime, 3 oz./4 gals. water September or March
Black aphis ..	Citrus	Small insects clustered on ends of new growth	DDT, ½ cup emulsion/4 gals., *or* nicotine sulphate, *or* H.E.T.P. 1 tablespoon/4gals.
5. Grape Vines.			
Downy mildew ..	Vines	Brown areas on leaves. Fruit clusters become rotten and covered with downy fungus	Bordeaux mixture (Note A*)— (1) Early October; (2) Late October; (3) January

* See Note page 422.

Insect Pest or Disease.	Fruit.	Symptoms.	Treatment.
5. Grape Vines—*continued*			
Erinose	Vines	Raised lumps on leaves, hairy on undersides	Lime sulphur, 3 pts./4 gals. water just before bud burst
Vine moth	Vines	Caterpillars, dark-green with yellowish markings — eat leaves from edge	Lead arsenate powder, 2 oz./4 gals. water
Black spot (anthracnose)	Vines	Purplish black spots on leaves, canes and fruit	Double strength Bordeaux mixture (Note A) at bud burst and ordinary strength before blooming and after setting. In winter, swab vines with 13 oz. sulphuric acid poured over 2 lb. iron sulphate dissolved in 1 gal. water in non-metallic vessel
6. Walnuts			
Black spot	Walnuts	Black spots on leaves and nuts	Difficult to control. Bordeaux mixture when growth commences, followed by three further sprays at 2–3-weekly intervals
Erinose	Walnuts	Raised lumps on leaves, hairy on undersides	Lime sulphur, 3 pts./4 gals. water just before bud burst
7. Passion Fruit			
Brown spot	Passion fruit ..	Brown areas on leaves and spots on fruit	½ strength Bordeaux mixture (Note A) in spring and early summer
Woodiness	Passion fruit ..	Fruits hard and woody. Leaves small, mottled, and distorted	No controls. Remove and burn affected vines. Don't prune vines until spring
8. Black Currants			
Currant borer moth ..	Black Currants ..	Caterpillars bore into young canes. Plants become sickly and foliage yellowed and dwarfed	In early spring cut out affected canes at ground level and burn

Note A

Normal strength Bordeaux mixture may be made as follows:—Dissolve 9 oz. copper sulphate (bluestone) crystals in 2 gallons of water contained in a non-metallic vessel. Mix 9 oz. slaked lime or limil in another 2 gallons of water and combine these two solutions. For different strengths, vary weight of materials, but keep volume the same.

Copper oxychloride may be used but is not as effective as Bordeaux.

Bordeaux paste may be made by dissolving 2 oz. copper sulphate in ½ pint water and adding slowly to 4 oz. slaked lime mixed in ½ pint water.

Note B

Some Handy Measures—

4 teaspoons = 1 tablespoon
2 tablespoons = 1 fluid ounce
7 fluid ounces = 1 cupful
20 fluid ounces = 1 pint
8 pints = 1 gallon
1 gallon water weighs 10 lb.
½ cup lead arsenate powder weighs approximately 2 ounces

Note C

Do not mix—

Lead arsenate and soap
Bordeaux mixture and soap
Lime sulphur and soap; lime sulphur and white oil as a summer spray

Garden Notes for October

By George Hyam, Horticultural Supervisor

THE FLOWER GARDEN

Asters for Cut-flowers or Garden Display

OCTOBER is the best month for starting successional sowings of asters, because the seed can now be sown in open beds and the hardy seedlings produced will transplant much better than early sowings that have been protected. There is little difference in the flowering time of seedlings sown now or those planted out this month.

Crego varieties are the most suitable for present sowing and successional sowings can be made until December. For mid-season flowering from February onwards, the best are Californian Giant varieties, which may be sown from the end of this month to January. American Beauty, which is the largest aster in cultivation, has globular flowers up to four inches across and this variety should not be sown before December or January as it is purely an autumn flowering variety. By sowing appropriate kinds in succession, it is possible to have displays of asters in bloom from January until the first frosts in May.

As the flowering period of each planting is not long, asters are best planted in massed rows of successive sowings in a separate bed for garden display. For cut flowers, they are better grown in single rows in the vegetable garden. Asters are not suitable for dot planting in mixed summer flower beds among other summer annuals with a longer flowering period. It is desirable to dust aster seed before sowing as a protection against seed-borne diseases. For this purpose, use any of the copper oxychloride preparations, such as cuprox or oxy-cop.

Sow in drills four inches apart not more than quarter inch deep, thinning the plants to about one inch apart at an early stage. They are best transplanted when about two pairs of leaves have been formed. The seed-bed should not be manured except with the lighest possible dusting of superphosphate, but a light mulch of compost or sieved old cow or horse manure can be used to cover the seed and help retain moisture.

Asters will grow in most soils, but in heavy types their seedlings do not establish so readily, as their root system at this stage is somewhat weak. When planted in heavy soils, it is best to fill in the planting holes with light soil or sand. Beds for asters should not be over-rich, but as they respond to superphosphate and potash, a light dressing of about ½ to 1 oz. of superphosphate and potash (5 : 1) should be raked in prior to planting. In sandy soils, the complete 5 : 1 : 1 superphosphate, ammonia and potash manure could be used instead. The potash element encourages good wiry stems and helps prevent the flower heads drooping.

As asters are shallow rooting and can be affected by surface heat, it is best to mulch round them as soon as the plants are established, especially on sandy soil. Asters should be kept moist but not over-watered. Too much water together with an excess of nitrogen in the soil, is the main cause of the "blind" or green flowers so often seen. Over-watering at any stage in inducive to aster wilt and other troubles.

COLOURFUL CANNAS

As a garden subject, cannas have been somewhat neglected in recent years, principally because they were often allowed to develop into a large unsightly clump instead of the plants being divided every second or third year. Cannas are very suitable for gardens that will not receive much attention during the summer months, and are particularly suited to damp positions, such as those alongside an open drain in country residences. They resist dry conditions quite well, but without fairly abundant watering, their flowers are smaller and the foliage tends to be dull and shabby looking.

Many good varieties of cannas growing to heights ranging from two to six feet can be obtained, and if these have been raised in pots, October is a good time to plant them. They need spacing three feet apart and where room permits, it is advisable to devote a bed or part of a bed entirely to them, using

varying heights to get a massed bank effect. Over-rich soil tends to produce leafiness, and an annual mulching applied in October is all that is needed to produce good results, though an application of liquid manure just before flowering will often deepen the colour and tints. Each winter, the previous season's stems should be cut off at ground level.

Cannas are not difficult to raise from seed which is obtainable from any seed merchant. It can be sown now or in autumn in open beds one inch deep. As soon as they are large enough to handle, the seedlings should be either grown on in nursery beds or in pots to produce a flower. It is then possible to see which are desirable to keep for permanent planting out, as like other hybrid plants, seedlings do not " come true " to the parent in regard to colours.

Other October Work in the Flower Garden

As the flowers of rhododendrons and azaleas fade, they should be stripped off by hand so as to leave the central bud intact, as it is from thence the new growth proceeds. On no account should seed pods be allowed to form. Any thinning out of old branches can be done this month, but should not be done too drastically in any one season. When flowers are required for decoration, they should be cut with short stems, taking care to leave a length of the newer green wood so that lateral buds from this will make new branches.

Roses are coming into full spring flush of flowers. As these fade, they should be cut off at a good bud, well down the stem, and no pods should be allowed to form. Roses for vases should be cut similarly.

In this climate, both tulips and hyacinth bulbs should be lifted every year. Lift the tulips at the first sign of the yellowing of the foliage after flowering, while hyacinths are best lifted while the foliage is still green. Before storing, both species should be " cured " by leaving them on the surface for a few days in some shady place until the leaves dry off and the skins of the bulbs harden and dry out. Store tulips in a cool place where the air can play freely around them. Hyacinths will tolerate a higher temperature but could be stored in a similar place.

Gardeners who intend planting buffalo, couch or kykuyu grass lawns are reminded that early October is the most favourable time for this work. If the area is kept well watered, it will be covered by runners early in January.

THE VEGETABLE GARDEN

Some Hints on Growing French Beans

Some October-sown crops of beans last year gave poor results on account of cool weather experienced in the spring. In normal seasons, however, early October is a good time to make the first of successional sowings of dwarf beans in all districts except on high elevations. In the higher country the first sowing is better deferred until the end of the month. In northern districts beans can be sown in September with little risk.

To obtain good pods, a rising soil temperature is needed so that the plants grow steadily to maturity without check. Cooler conditions result in stunted plants, a poor setting, and small, twisted pods. As the yellow wax-pod or butter bean grows rather better in cool weather than the green French bean, it is often safest to make the first sowing with these in doubtful weather.

Prepare the beds in September for October sowings and in garden soil of average fertility, simple digging is all that is required. The heavy soils should be made more friable with some organic manure lightly forked into the top three or four inches.

The necks of beans emerge through the surface before the leaves, and if these meet a compacted surface, they are liable to break, leaving the growing tip under-ground to decay. The resultant poor strike is often wrongly attributed to the quality of the seed. Planting too deeply in any class of soil also may have the same effect. This can be avoided either by ensuring the friability of the soil by adding humus material or in very heavy soils, by covering the seed drills with light soil. In all soils, beans should be planted shallower than peas, about two inches in light soils and one inch in heavier types.

In the home garden, beans are best planted in double rows spaced six to eight inches apart for mutual support against wind. The seeds are spaced about five inches in the rows, and "staggered" so that no two are opposite each other. The simplest method of sowing is to take out a shallow drill twelve to fourteen inches wide at the correct depth, placing the seeds in the centre and applying the fertilizer in bands as described in last month's notes. In garden soils of reasonable fertility, superphosphate at the rate of 1 oz. per yard of row is all the fertilizing that is necessary, but in poorer soils the same quantity of 5 : 1 : 1 complete manure should be used. Apply fertilizer so that it does not come in contact with the seed.

Dwarf beans in double rows support each other against wind.

When the beans come through the ground and until they grow about four inches high, they should be banked up a little, but after that stage any cultivation around them should be shallow as their root system is spreading and close to the surface.

Weeds are best kept to a minimum by working the soil well before sowing and, after the initial earthing up, by means of a mulch which will also help to conserve moisture. If possible, beans should be grown between rows of taller-growing crops, as their yield can be greatly affected by wind especially in the case of isolated rows. Where possible, the rows should be placed so that the prevailing winds can blow down the rows and not across them.

Bean Varietal Differences

The list of varieties of French and wax-pod beans at present available is not so great as before the war, and some good garden kinds are not now obtainable. Those now being sold are varieties most favoured for commercial growing.

Beans, like tomatoes, and some other vegetables are influenced to some extent by differences in soils and climates and differ in regard to their cropping habits. Some, like Brown Beauty, set their pods in one flush; others like the Canadian Wonder and its selections crop over a longer period. Varieties differ also in the time they take from seed to maturity.

To provide a succession throughout the season, the gardener would now be well advised to try sowings of any variety available and note their performances under his own particular local conditions. It will be found best to make smaller and less frequent sowing of Hawkesbury Wonder which crops over a longer period. If rows of Feltham Prolific or New Discovery are sown at the same time as Brown Beauty, they will pod a little later, and then continue to pod over about four weeks. Others that produce continuous crops for about the same period are Staley's Star and Staley's Surprise. Green Stringless beans will crop for about six weeks in most districts, although all may differ a little, according to district conditions.

Most wax-pods, and especially Startler Wax, start to crop before they are fully grown and continue for some weeks.

The climbing perennial beans crop in flushes throughout their season which is roughly from January until the first frosts. Annual kinds, such as Epicure, crop continuously over a period rather longer than the cropping of dwarf French beans. With the exception of Epicure, climbing beans should not be sown until November, except in the north (where they can be sown in October), as they need a higher temperature than dwarf varieties.

Melons in Southern Victoria

While there is no difficulty in growing melons of various kinds north of the Divide, cropping melons in the south is not so easy.

(Continued on page 427).

CERTIFIED PULLORUM-TESTED FLOCKS (POULTRY)

A certified Pullorum-Tested Flock is one in which all stock over six months of age have given a negative reaction to the agglutination test for Pullorum Disease, and in which all such stock are kept under rigid conditions of isolation approved by the Chief Veterinary Inspector.

The undermentioned flocks have been certified by the Department of Agriculture, and will remain so for the current calendar year, or until such time as the Chief Veterinary Inspector determines.

Application forms are obtainable from the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

Particulars of breeds of birds tested are as shown hereunder:—

A. Australorp; B. White Leghorn; C. Rhode Island Red; D. Sussex; E. Langshan; F. Brown Leghorn; G. Buff Orphington; H. Black Leghorn; I. Minorca; J. Ancona; K. Legbar; L. Indian Game.

Owner.	Breed.	Number of Birds.
Agricultural College, Dookie	A, B	1,726
Anderson, G. M., Greensborough-road, Macleod	A	1,488
Anguey, H., 138 Hargreaves-street, Castlemaine	A, B	725
Arnold, J. B., Terrara-road, Vermont	A	810
Ashgrove Poultry Farm, Cockatoo	A, B, C, D	3,035
Baker, J., Greensborough	A	1,077
Barastoc Experimental Farm (G. Lee Manager), Croydon	A. B, C	716
Bassett, R. A., South Muckleford	A, B	345
Bayfield, A. E., Seven Acres Poultry Farm, Springvale	B, C	1,374
Bingley, A., 333 Highbury-road, Burwood	A, B	2,108
Bird, F. V., Middlebro-road, Box Hill	A	323
Bishop, Mrs. P. M., Springvale-road, Springvale	A, B, C,	1,810
Boyce, A. D., Springvale-road, Forest Hill	B	1,097
Bray, J., 18 Hotham-street, Warrnambool	B	140
Brumby, W. E., Ellendale-road, Noble Park	A, C	438
Burney and Pound, North-road, Langwarrin	A, B	1,731
Cannings, P. G. A., Shepparton East	B	3,932
Carlella Poultry Farm (J. W. Stoneman), Campbell's-road, Briar Hill	C, F	272
Cashin's Poultry Farm, 2 Dawson-street, Stawell	A, B	2,528
Chalmers, H. L., 9 Lefevre-street, Spotswood	B, F, K	582
Chamberlain, L., Nathalia	A, B	1,984
Chapman, Mrs. E., Youanmite	A, C	282
Christie, R. R., and Son, Tucker-road, Bentleigh	A, B, C	879
Cole, R., Mooroopna	B, C	416
Collins, A. J., Emerald	A, C	354
Colquhoun, Dr. W. L., "Aringa," Ringwood	A, B	195
Cook and McKnight, Croydon	A	1,568
Corbett Bros., Torbay-street, Macleod	A	2,318
Coupar, J. E., Box 18, Nathalia	A, B, C	388
Davidson and O'Keefe Hatchery (Mrs. M. H. Turner, Prop.), 22 Sherwood-avenue, Ringwood	A, B	75
Davies, L. F., Westall-road, Springvale	A, C	1,368
Davis, C., Tarilta	A, B	866
Davis, N. W., Mickleham, via Broadmeadows	A, B	3,089
Dawson, R. G., Maldon-road, Castlemaine	B	1,285
Day, L., Box 39, Kyabram	A, B, C	1,778
Deakin, J., 21 Troy-avenue, Bonbeach	A, B	301
De Gruchy, Mrs. F., 56 Kingsville-street, West Footscray	C	50
Dugan Bros., Broadmeadows	B	8,864
Ellen J. Rossmoyne Pig and Poultry Farm, Avoca	A, B	1,919
Emmott, J. T., Verdon-street, Inglewood	A, B	293
Farmer, C. R., Whitehorse-road, Ringwood	A, B, C, D, K	2,260
Fellows, J., Yan Yean-road, Plenty	A, B, C	859
Fitchett, C. W., Spring Vale-road, Tally Ho	A, B	1,484
Fletcher, J. H., "Homeleigh," Tallygaroopna	B	1,621
Ford, J. V., 11 Barkers-avenue, Shepparton	A, B, C	1,026
Fraser, R. A., and Son, Colchester-road, Kilsyth	A, B, C	947
Frye, I. H., Grimshaw-street, Watsonia	A, B	1,937
Gedye Bros., Railway-road, Blackburn	A, B	3,775
Giarrusso, G., Lower Dandenong-road, Braeside	B, C	462
Gibbs, A. E., Stanhope	A, B	3,734
Gibbs, J. L., Lower Plenty	A. B	983
Graham, C., All Black Poultry Farm, Portarlington	A	50
Grenville Poultry Farm, Springvale-road, Springvale	A, B, C	3,666
Guy, J., "Murlea," Murgheboluc	A, B, C	670
Gwyther, R. P., "Woorrayl," Highton	A, B	1,144
Hamblin, N. A., Sunny Hill Poultry Farm, Toolleen	A, B	3,423
Hanson, S., Kilmore	A	237
Harrington, G. W., Springvale-road, Tally Ho	B	1,836
Harrington, W. H., Woodward-street, Golden Square	A	1,597
Harrison, A., Shenfield-street, Cobden	A, B, C, D	300
Hayes Bros., Mount Dandenong-road, Montrose	A, B	3,564
Henderson, C. W., Shepparton	A	395
Henderson, W. R., 22 Chesterville-road, Cheltenham	A, I	254
Hewett, A. T., Central-avenue, Croydon	A, B	866
Hopkins, C. A., and Sons, Success Poultry Farm, Knight-street, Shepparton	A, B	1,656
Hunt, R. R., 365 Highbury-road, Burwood	A, B	1,298
Hurst, B. H. G. (Mrs.), New-street, Eltham	B	2,768
Ikin, E. J., 44 McKay-street, Seddon	C	86
Inglis, W. J., Cobham-road, Mitcham	A, B	530
Jackson, Miss E. M., 4 Monash-street, Box Hill	B	48
James, D. E. and K. D., Spring Gully, via Bendigo	A, B, C	1,127
Johnson, A. S., Burwood-road, Ferntree Gully	A, B, C	2,282
Kay, V., 12 Wellington-street, Blackburn	A, B	2,634
Kenneally, W. R., Hallam-road, Hampton Park	A, B	1,503
Kennedy, F., Ferntree Gully-road, Glen Waverley	A, B, C	677
Kerr J. J., Clarke-road, Springvale	A, B	2,052
Kostos Bros., Oakleigh	A, B, C	473
Lang, J. L., 46 Dundas-street, Thornbury	E	104
Lattimore, A. G., Kilsyth	A, B, C	817
Lechte Bros., Dondardon Poultry Farm, Mount Waverley	B	2,175
Lintermans, W. A. J., Major-road, Lysterfield	C	1,160
Longerenong Agricultural College, Dooen	A, B	720
Lonie, R. A., 1 Chanak-street, East Malvern	A, B, C	37
Lucas and de Molnar, 4 Downong-street, Blackburn	A, B	1,639
Magnusson, L., Nathalia	B	936
Maher, A. E., Wal Wal	A, B	765
Major, C. D., Simpsons-road, Eaglehawk	A, B	2,000
Marshman, A. R., Archie's Creek	A, B, C	767
McCabe, R., Gladstone-road, Dandenong	A, B, D	2,079
McCann and Sons, Crowlands-road, Stawell	B	4,198
McEwan, A. W. H., Whitehorse-road, Ringwood	A, B, K	157
McLauchlan, D. F., Rossiter-road, Koo-wee-rup	A, B	2,500
McTighe, C. H., Nar-Nar-Goon	A	571
McVay, A., Kernot-street, West Spotswood	A, B	2,506
Mead, J. L., 28 Golf Links-avenue, Oakleigh	A, B	254
Mills, J. J., Kelvinside-road Noble Park	C	267
Mold Bros., Banbury Park Poultry Farm. Old Narre Warren-road, Emerald	A, B	1,141
Molsons White Leghorn Stud (G. Durkin, Man), 188 Surrey-road, Blackburn	B	1,311

CERTIFIED PULLORUM-TESTED FLOCKS (POULTRY)—*(continued).*

Owner.	Breed.	Number of Birds.
Moran, S. G., Glenburnie-road, Mitcham ..	A, B	732
Moroney, J. B., Kangaroo Flat	B	1,150
Mumford, L. J., Healesville	A	400
Neal, J. H., 18 Watt-street, Spotswood ..	L	22
Niewand, F. J., "Kalang," Lubeck ..	A, B, C	1,275
O'Brien, R. J., Watson-road, Glen Waverley	A, C	694
Paton, W. S., Glenburnie-road, Mitcham ..	A, B	477
Poulton, A. W., Vickers-street, Sebastopol	A, B, C	2,321
Rae, J., Albert-street, Sebastopol ..	B, C	1,889
Ranleigh Poultry Farm (D. H. Tokimosa, Prop.), Dingley	A, B	743
Ridge and Son, 42 Myrtle-grove, Blackburn	A, B, C	3,045
Robinson, W., 11 Olive-street, Hampton ..	B, C	1,029
Rose, H., Yarrambat	B	583
Rowe, Mrs. L. M., "The Wattles," Wal Wal	A, B	319
Salmond, J. B., Deer Park	H	246
San Miguel, M. H. (Mrs.), Woodhouse-grove, Box Hill	A, B	1,896
Scales, J., West Wattle Tree-road, Boronia..	A	1,492
Settle, J. H., Stanhope	A, C	2,491
Simpson, G. D., May-road, Glen Waverley ..	B	2,928
Smith, A. W. and M. P., Terang Poultry Farm, Terang	B	969
Smith, F., Lenham Poultry Farm, Terang	A, B	3,307
Smith, H. A., Marong-road, Maiden Gully ..	A, B, C	1,196
Snodgrass, R., Pakenham East	B	1,352
Stant, W. J. and F. E., Westall-road, Spring Vale	A, B, C	2,957
State Research Farm, Werribee	A, B	2,062
Stewart, J., Maldon-road, Castlemaine ..	A, B	565
Stewart, P. D., Bayswater-road, Croydon ..	A, B	1,028
Streeter, H. A., Avoca	B	508
Swift, D. A., Kangaroo Flat	A, B	2,313
Taylor, H. L., 180 Surrey-road, Blackburn..	A, B	1,389
Taylor, H. R., Rosebank Poultry Farm, Reservoir	A, B, C	5,357
Taylor, R. H., 132 Rathgowan-road, Reservoir	A, B, C	3,730
Teitz, G., 21 Kingsley-crescent, Mont Albert	B	736
Thomson, S. R., Bacchus Marsh-road, Corio	A, B, C	1,543
Voigt, A. H., Sunnyside Poultry Farm, Follett-road, Cheltenham	A, B	1,412
Walton, F. R., Woodvale-road, Boronia ..	A, C	707
Wandong Poultry Farm (Mrs. M. E. Trembath), Lawn-road, Noble Park	A, B	1,512
Webb, A. E. H., Frankston-road, Cranbourne	A, B	5,653
Welch, T. A., Bayswater-road, Croydon ..	A, B	3,062
Wesley, J. H., "Fairview," Kangaroo Flat	A, B, C	1,210
Williams, V., 91 Tone-road, Wangaratta	A, B	778
Winter, G. A., "Denehurst," Murgheboluc	A, C	355

THE VEGETABLE GARDEN—*(continued from page 425).*

This is due to the fact that most melons need warmer conditions than other cucurbits. If certain points are observed, however, it is possible to get satisfactory garden crops in districts with climates similar to Melbourne. Melons of all sorts have a longer growing season than other cucurbits, and this is lengthened if the weather is cool. They need a fairly warm soil temperature to start them into vigorous growth.

In southern areas, very few fruits will be obtained unless the plants have reached the flowering stage by the end of the year, which means that the seeds should be sown in early October when outside soil temperatures are still rather low. In such areas it is advisable to sow rock or water melons in pots or tins early in the month, and to keep these under shelter for the first month or so, planting them out at the end of November on specially prepared sites. These are made by placing a bucketful of fresh horse manure under each plant at a depth of about eight inches, ramming it down to form a layer about five inches deep. This acts as a small hot-bed to force along the plant in its early stage of growth and eventually feeds the plant. The Cassaba or Honey Dew, which fruits late, is perhaps the best dessert melon to grow in southern areas. It's fruits store for some time.

STANDARD HERD TEST REPORT—*(continued from page 392).*

The Six Leading Cows in Each Section, 1948–49

Name of Cow.	Owner.	Class and Breed.	Butterfat.
		Mature.	lb.
Ingolston Gwen	Goodfellow, P. W., and Sons	Friesian	917·3
Victoria Olga	Department of Agriculture	Friesian	905·3
Inverurie Thistledown	Goddard, J. H.	Ayrshire	840·5
Inverbroom Air Marie	Wade, G. F.	Jersey	831·6
Bamawm Bonnie Madeira	Williams, L.	Jersey	819·8
Willow Park Duchess 35th	Atkinson, Estate Late W. K.	Dairy Shorthorn	791·1
		Senior four-year-old.	
Elm Grove Songstress 5th	Gay, W. C. R.	Jersey	814·9
Francliff Prudence	Broad, R. C.	Jersey	680·4
Shenstone Gem 6th	Emmett, Mrs. S., and Sons	Jersey	670·1
Elm Grove Glowing Dawn	Gay, W. C. R.	Jersey	654·8
Kooreena Carrie 20th	Hurrey, Estate Late W. H.	Jersey	645·8
Rutland Noella 3rd	Masters, Estate of Late S. H., and Son	Jersey	631·3
		Junior four-year-old.	
Douglas Vale Kassie	Tandberg, G., and Son	Illawarra Shorthorn	717·9
Elm Grove Songstress 6th	Lineham, P. W.	Jersey	684·9
Surrey Starette 14th	Stedman, J.	Jersey	684·4
Surrey Lady Doreen 22nd	Stedman, J.	Jersey	677·8
Mornmoot Fancy Starbright 16th	Young, N. H.	Jersey	617·3
Avonview Diana	Fixter, A.	Guernsey	592·3
		Senior three-year-old.	
Inverurie Flirt	Goddard, J. H.	Ayrshire	775·2
Yarraview Golden Daffodil	Payne, A. E. T.	Guernsey	736·0
Lumeah Soprano	Charlton, G. F.	Jersey	637·5
Waroin Delightful Butterfly	Keele, H. A.	Jersey	596·5
Glenvalley Duchess Pride	Gilmour Brothers	Jersey	586·4
Shenstone Linda 12th	Emmett, Mrs. S., and Sons	Jersey	585·8
		Junior three-year-old.	
Grangeville Goldie 2nd	Broad, E. E.	Jersey	648·5
Alexandra Golden Lass	Felmingham, L. J.	Jersey	630·0
Surrey Lady Doreen 24th	Stedman, J.	Jersey	622·4
Englauscot Blossom	Leggate, W. J.	Guernsey	622·0
Surrey Boronia 31st	Stedman, J.	Jersey	604·6
Langi Janie	Watts, J. S.	Jersey	603·0
		Senior two-year-old.	
Melrock View Moleen	Mulheron, J.	Jersey	615·5
Larconia Posy 5th	Maloney, C. P.	Jersey	556·3
Elm Grove Island Queen 6th	Lineham, P. W.	Jersey	544·3
Selsey Samares Lotus 2nd	Thompson, H. D. L.	Jersey	541·2
Lynbrae Rosette	Gilmour Brothers	Jersey	532·4
Ballam Vera's Virginia	Gilmour Brothers	Jersey	519·8
		Junior two-year-old.	
Yarraview Admiration	Payne, A. E. T.	Guernsey	621·5
Elenko Primrose	Williams, L.	Jersey	605·4
Eurarie Princess	Till, J. A.	Jersey	545·4
Kingsvale Rosella 93rd	Anderson, J., and Son	Jersey	543·1
Warwick Design's Mauve	Walker, C. S.	Jersey	525·4
Inverell Stella 5th	Dowel, H. H.	Jersey	518·3

List of Cows Producing 600 lb. Butterfat or Over, 1948–1949

Name of Cow.	Owner.	Class.	Breed.	Butterfat.
				lb.
Ingolston Gwen	Goodfellow, P. W. and Sons	Mature	Friesian	917·3
Victoria Olga	Department of Agriculture	Mature	Friesian	905·3
Inverurie Thistledown	Goddard, J. H.	Mature	Ayrshire	840·5
Inverbroom Air Marie	G. F. Wade	Mature	Jersey	831·6
Bamawm Bonnie Madeira	Williams L.,	Mature	Jersey	819·8
Elm Grove Songstress 5th	Gay, W. C. R.	Senior 4	Jersey	814·9
Willow Park Duchess 35th	Atkinson, Estate Late W. K.	Mature	Dairy Shorthorn	791·1
Inverurie Flirt	Goddard, J. H.	Senior 3	Ayrshire	775·2
Yarraview Carol	Payne, A. E. T.	Mature	Guernsey	768·2
Victoria Rita	Department of Agriculture	Mature	Friesian	757·5
Elm Grove Dairymaid 5th	Gay, W. C. R.	Mature	Jersey	742·8
Yarraview Golden Daffodil	Payne, A. E. T.	Senior 3	Guernsey	736·0
Bangalow Vale Carmine	Scott, C. W.	Mature	Guernsey	721·6
Douglas Vale Kassie	Tandberg, G. and Son	Junior 4	Illawarra Shorthorn	717·9
Kooreena Yo Yo 14th	Hurrey, Estate Late W. H.	Mature	Jersey	713·8
Tolgarth Illusion (Imp., N.Z.)	Walker, C. S.	Mature	Jersey	711·8
Pine Ridge Duke's Silvermine 3rd	Lethlean, R.	Mature	Jersey	698·5
Inverell Consent 6th	Dowel, H. H.	Mature	Jersey	693·3
Victoria Electricity	Department of Agriculture	Mature	Red Poll	692·9
Lumeah Veronica May	Withall, H. L.	Mature	Jersey	689·9
Elm Grove Songstress 6th	Lineham, P. W.	Junior 4	Jersey	684·9
Surrey Starette 14th	Stedman, J.	Junior 4	Jersey	684·4
Surrey Bonnie Madeira 11th	Stedman, J.	Mature	Jersey	682·8
Francliff Prudence	Broad, R. C.	Senior 4	Jersey	680·4
Surrey Lady Doreen 22nd	Stedman, J.	Junior 4	Jersey	677·8
Shenstone Naldera	Emmett, Mrs. S., and Sons	Mature	Jersey	677·1
Surrey Golden Satisfaction	Stedman, J.	Mature	Jersey	676·8
Maryville Etna	Butcher, F. T.	Mature	Red Poll	672·4
Bamawm Princess Noella 2	Williams, Estate Late F. A.	Mature	Jersey	671·1
Shenstone Gem 6th	Emmett, Mrs. S. and Sons	Senior 4	Jersey	670·1
Elm Grove Laurette 5th	Gay, W. C. R.	Mature	Jersey	658·3
Elm Grove Glowing Dawn	Gay, W. C. R.	Senior 4	Jersey	654·8
Milvue Peggy	Hore, R. L.	Mature	Jersey	654·7
Glenoak Popular Melody	Scott, C. W.	Mature	Guernsey	653·1
Mer Vue Choice Variety 2	Clarke, F. W.	Mature	Jersey	652·4
Grangeville Goldie 2nd	Broad, E. E.	Junior 3	Jersey	648·5
Eurarie Sparkle 3rd	Till, J. A.	Mature	Jersey	648·0
Kooreena Carrie 20th	Hurrey Estate, Late W. H.	Senior 4	Jersey	645·8
Maneroo Mabel 4th	Medland, F. C.	Mature	Jersey	645·6
Ismalia Garenne 5th	Murdoch, J., and Sons	Mature	Jersey	643·2
Koromiko F. P. Buttermaid (Imp. N.Z.)	Clifford, Hon. L.	Mature	Friesian	643·1
Merrilyn Fernleaf's Love	Young, W. V.	Mature	Jersey	640·8
Radford Rosemary	Chester, E. N.	Mature	Jersey	639·2
Lumeah Soprano	Charlton, G. F.	Senior 3	Jersey	637·5
Gowerville Delia	Goodfellow, P. W., and Sons	Mature	Friesian	636·9
Eurarie Betty	Till, J. A.	Mature	Jersey	634·1
Lynbrae Water Lily 3rd	Peck, R. A.	Mature	Jersey	632·3
Rutland Noella 3rd	Masters, Estate Late S. H. and Son	Senior 4	Jersey	631·3
Mer Vue Choice Light	Clarke, F. W.	Mature	Jersey	630·3
Alexander Golden Lass	Felmingham, L. J.	Junior 3	Jersey	630·0
Belgonia Peggy 29th	Maloney, P. J.	Mature	Jersey	628·1
Yarraview Heritage	Payne, A. E. T.	Mature	Guernsey	627·1
Surrey Golden Satisfaction	Stedman, J.	Mature	Jersey	626·5
Kooreena Cream Belle	Hurrey, Estate Late W. H.	Mature	Jersey	624·4
Rosevale Rosy's Rose	Wade, G. F.	Senior 4	Jersey	623·8
Shenstone Primula 4th	Emmett, Mrs. S., and Sons	Mature	Jersey	623·0
Surrey Lady Doreen 24th	Stedman, J.	Junior 3	Jersey	622·4
Eltekon Miss Importance	Bruhn, C. H. and V. I.	Mature	Jersey	622·2
Englauscot Blossom	Leggate, W. J.	Junior 3	Guernsey	622·0
Yarraview Admiration	Payne, A. E. T.	Junior 2	Guernsey	621·5
Elm Grove Duchess 2nd	Gay, W. C. R.	Mature	Jersey	619·3
Warwick Tranquil Star	Williams, L.	Mature	Jersey	618·6

List of Cows Producing 600lb. Butterfat or Over, 1948–49—*continued.*

Name of Cow.	Owner.	Class.	Breed.	Butterfat.
				lb.
Mornmoot Fancy Starbright 16th	Young, N. H.	Junior 4	Jersey	617·3
Edenhope Milkmaid 5th	Bennett, R. H., and Sons	Mature	Jersey	616·0
Melrock View Moleen	Mulheron, J.	Senior 2	Jersey	615·5
Elm Grove Linda 16th	Lineham, P. W.	Senior 4	Jersey	614·6
Kingsvale Linda 107th	Anderson, J., and Son	Mature	Jersey	614·4
Selsey Rowan 4th	Nicholas, M. A.	Mature	Jersey	613·4
Belgonia Buttercup 12th	Maloney, P. J.	Mature	Jersey	612·7
Vermont Bluebell	Hearn, Miss I. K.	Senior 4	Guernsey	611·8
Vermont Benefactoress	Hearn, Miss I. K.	Mature	Guernsey	610·8
Elmgrove Linda 15th	Lineham, P. W.	Mature	Jersey	608·0
Yarraview Chamois	Payne, A. E. T.	Mature	Guernsey	607·1
Stonybank Gaiety Girl 17th	Heffernan Brothers	Mature	Jersey	606·5
Windrest Chevy's Beauty	Haywood, Dr. A. R.	Mature	Jersey	606·4
Eurarie Princess 2nd	Till, J. A.	Mature	Jersey	605·6
Elenko Primrose	Williams, L.	Junior 2	Jersey	605·4
Surrey Boronia 31st	Stedman, J.	Junior 3	Jersey	604·6
Mer Vue Butterball 2nd	Charlton, G. F.	Mature	Jersey	603·6
Langi Janie	Watts, J. S.	Junior 3	Jersey	603·0
Ryelands Stylish Dainty	Phillips, J. H.	Mature	Jersey	602·4
Wolrah Tangerine 2nd	Ware, F. E., and H. H.	Mature	Jersey	601·6
Yarraview Clara's Fashion	Payne, A. E. T.	Mature	Guernsey	600·5
Deepdale Polly 3rd	Parker, L. M.	Mature	Dairy Shorthorn	600·0
Verbank Silver Madeira	Lineham, P. W.	Mature	Jersey	600·0

No. of Cows Yielding 500 lb. Butterfat or over—1948–49

Class.	900 to 1,000 lb.	800 to 900 lb.	700 to 800 lb.	600 to 700 lb.	500 to 600 lb.	Total.
Mature	2	3	7	47	207	266
Senior 4-year-old	..	1	..	8	39	48
Junior 4-year-old	..	..	1	4	39	44
Senior 3-year-old	..	..	2	1	41	44
Junior 3-year-old	..	..	..	6	20	26
Senior 2-year-old	..	..	..	1	9	10
Junior 2-year-old	..	..	..	2	8	10
Grand Totals	2	4	10	69	363	448
1947–48 Totals	..	1	8	42	259	310

Averages 1948–1949
(273 Days' Lactation Period.)

Class.	Number in Class.	Average Butterfat 273 Days (Without Allowances).	Average Butterfat 273 Days (With Allowances).
Junior 2	1,445	293	413
Senior 2	524	310	410
Junior 3	678	331	411
Senior 3	556	351	411
Junior 4	474	363	403
Senior 4	407	367	387
Mature	2,102	373	..
Total	6,186	..	..

Average all classes without allowances=341 lb. butterfat.
Average all classes with allowances=396 lb. butterfat.

HERD AVERAGES, 1948–1949

Owner.	Breed.	Junior 2-year-old.		Senior 2-year-old.		Junior 3-year-old.		Senior 3-year-old.		Junior 4-year-old.		Senior 4-year-old.		Mature.		Total Herd.	Average Butter-fat without Allowances.	Average Butter-fat with Allowances.
		No.	Average Butter-fat.	No.	Average Butter-fat.	No.	Average Butter-fat.	No.	Average Butter-fat.	No.	Average Butter-fat.	No.	Average Butter-fat.	No.	Average Butter-fat.	No.	lb.	lb.
			lb.		lb.		lb.		lb.		lb.		lb.		lb.			
Herds of 15 Cows and Over																		
1. Stedman, J. ..	Jersey ..	6	441·4	—	—	4	503·7	1	566·3	3	617·3	1	569·7	7	594·2	22	536·8	596·7
2. Gay, W. C. R...	,, ..	3	392·5	1	347·0	1	415·2	1	495·3	—	—	2	734·9	7	596·9	15	538·9	581·5
3. Goodfellow, P. W. and Sons	Friesian..	4	410·1	1	486·0	2	453·5	4	465·3	1	417·7	—	—	6	625·0	18	503·5	561·6
4. Phillips, J. H. ..	Jersey ..	6	429·1	2	452·4	2	467·4	—	—	1	478·9	2	572·8	3	571·1	16	484·5	557·5
5. Charlton, G. F.	,, ..	8	382·3	1	438·4	1	470·5	4	549·4	—	—	—	—	7	540·0	21	473·6	542·3
6. Hurrey, Estate Late W. H.	,, ..	4	324·0	2	407·9	2	503·9	3	444·9	—	—	5	513·3	5	612·4	21	480·1	536·5
7. Mulheron, J. ..	,, ..	3	366·3	3	476·8	3	446·3	4	488·4	5	464·2	1	519·5	1	538·5	20	460·0	530·5
8. Till, J. A. ..	,, ..	8	389·8	3	450·8	3	433·1	3	506·5	1	489·5	3	506·3	13	504·3	34	466·3	528·2
9. Lineham, P. W.	,, ..	14	370·5	5	449·0	5	431·9	4	517·5	2	622·0	3	506·2	14	473·8	47	448·0	527·0
10. Department of Agriculture	Friesian..	5	350·7	1	391·6	2	410·1	2	494·6	—	—	1	440·2	11	553·4	22	476·4	525·4
11. Jennings, C. J.	Jersey ..	2	383·3	2	454·5	10	453·4	2	427·4	—	—	2	519.6	8	499·5	26	465·4	524·7
12. Emmett, Mrs. S., and Sons	,, ..	7	334·7	2	441·2	1	441·8	3	484·4	3	488·3	1	670·1	8	532·7	25	460·7	523·3
13. Watts, J. A. ..	,, ..	3	338·6	1	352·3	1	603·0	5	478·7	2	487·1	2	463·9	1	518·8	15	452·4	523·0
14. Scott, A. L. ..	,, ..	2	393·8	3	423·3	3	414·9	2	456·2	3	510·5	1	478·0	1	550·4	15	451·6	521·0
15. Masters and Son, Estate of late S. H.	,, ..	4	352·6	1	464·3	7	414·4	1	473·6	4	477·3	1	631·3	4	520·1	22	448·6	514·8
16. Broad, E. E. ..	,, ..	9	397·6	—	—	7	453·5	1	459·1	4	484·7	—	—	6	444·3	27	437·7	512·6
17. Payne, A. E. T.	Guernsey	6	391·3	—	—	5	333·2	4	503·3	1	588·0	2	394·7	11	523·7	29	454·0	510·6
18. Thompson, H. D. L.	Jersey ..	5	379·8	5	434·8	4	427·0	1	440·9	1	411·4	—	—	—	—	16	414·6	510·1
19. Young, N. H. ..	,, ..	9	358·6	3	463·4	9	412·4	6	452·2	7	480·2	2	356·1	5	494·2	41	429·0	509·8
20. Christy, W. A...	,, ..	—	—	—	—	2	380·3	4	464·3	4	508·9	—	—	8	474·6	18	469·5	502·1
21. Delaney, Mrs. H. A.	,, ..	7	353·5	2	432·6	2	409·3	4	489·0	1	409·3	—	—	5	460·1	21	420·2	493·6
22. Goddard, J. H.	Ayrshire	8	337·3	—	—	1	518·0	2	617·6	4	398·0	1	342·1	3	541·9	19	420·6	493·1
23. Dowel, H. H. ..	Jersey ..	9	365·4	3	414·6	4	389·6	1	426·9	4	454·0	4	440·3	12	471·8	37	425·8	490·9
24. Dowel, A. E. ..	,, ..	2	295·7	3	386·5	1	505·8	4	444·7	—	—	—	—	9	483·1	19	441·2	488·5
25. Scott, C. W. ..	Guernsey	6	349·3	—	—	1	485·2	2	285·3	—	—	1	536·7	10	505·8	20	437·3	486·8
26. Keele, H. E. ..	Jersey ..	10	313·2	4	465·8	3	302·7	8	436·1	—	—	—	—	10	493·5	35	409·3	485·6
27. Walker, C. S. ..	,, ..	8	383·6	1	292·3	2	375·3	—	—	1	476·3	2	434·7	16	472·5	30	433·9	484·7
28. Clarke, F. W. ..	,, ..	12	303·9	5	356·9	3	345·9	8	439·3	3	446·2	1	580·1	11	492·1	43	402·6	481·7
29. Wade, G. F. ..	,, ..	4	322·5	3	341·4	2	354·2	—	—	4	398·6	1	623·8	3	600·3	17	414·2	481·1
30. Clark, P. W. and Sons	,, ..	14	359·8	1	289·3	2	469·0	4	412·5	4	435·1	1	371·5	5	436·9	31	393·8	478·0
31. Tandberg, G. and Sons	A.I.S. ..	3	296·4	2	382·0	3	405·7	3	497·2	3	455·9	4	456·0	3	412·4	21	418·6	477·8
32. Bennett, J. W.	Jersey ..	15	346·7	4	379·7	9	398·9	6	391·0	4	411·4	5	416·5	7	438·0	50	389·0	477·3
33. Bruhn, C. H., and V. I.	,, ..	4	352·1	1	434·0	2	396·2	5	403·0	—	—	3	473·5	10	452·2	25	423·7	475·1
34. McKenzie, A. E.	,, ..	8	350·3	4	398·3	—	—	1	446·2	2	435·8	1	449·4	9	448·3	25	407·9	473·7
35. Gardener, J. L.	,, ..	2	287·8	—	—	2	376·0	4	408·7	—	—	5	447·0	19	469·8	32	441·4	473·0
36. Broad, R. C. ..	,, ..	11	329·8	6	403·2	5	393·2	1	416·1	1	365·2	5	489·2	18	426·8	47	402·6	472·2
37. Trevaskis, F. T.	Jersey ..	5	314·3	3	412·5	3	375·0	3	497·2	4	419·6	1	548·2	5	408·2	24	403·9	470·9
38. Harvey, Hon. T.	,, ..	19	348·0	1	342·1	7	374·9	2	459·7	1	375·7	—	—	10	418·2	40	376·4	466·4
39. Chester, E. N.	,, ..	12	312·5	1	366·6	2	393·8	3	370·7	2	475·0	1	407·7	16	466·3	37	401·0	465·5
40. Broad, Mrs. A. A.	,, ..	—	—	1	465·9	2	433·8	—	—	1	450·0	3	505·9	9	416·7	16	440·7	463·7
41. Burgman, Jack	Friesian..	4	371·1	—	—	2	360·6	—	—	—	—	4	398·0	5	487·0	15	415·5	463·5
42. Maloney, C. P...	Jersey ..	4	299·6	5	404·7	3	438·0	2	488·3	1	393·0	2	464·0	10	409·1	27	404·6	463·2
43. Nicholas, M. A.	,, ..	6	297·4	1	343·3	4	411·1	1	450·4	1	408·7	1	504·2	7	443·3	21	392·3	461·0
44. Bennett, R. H., and Sons	,, ..	6	292·2	1	285·5	1	314·6	—	—	4	484·9	5	475·1	8	441·5	25	408·0	459·4
45. Jackson, H. ..	,, ..	10	321·0	2	434·7	3	385·6	1	490·8	1	473·1	—	—	2	366·4	19	364·9	458·5
46. Read Est. late J. D.	,, ..	11	303·8	2	415·4	6	430·6	—	—	3	366·3	4	406·2	12	438·7	38	388·0	457·4
47. Jardine, W. R.	,, ..	9	339·3	2	343·8	1	447·6	3	403·3	—	—	3	417·1	4	438·7	22	380·2	456·4
48. Burgman, J. E.	,, ..	10	314·0	1	325·4	2	415·0	6	437·7	—	—	—	—	6	420·4	25	377·4	455·2
49. Burgman, F. A.	,, ..	11	324·4	4	366·0	7	389·1	1	306·0	3	517·8	—	—	8	382·9	34	372·9	454·7
50. Gilmour Brothers	,, ..	6	351·6	5	444·4	1	346·8	4	482·1	3	314·0	1	369·8	6	345·8	26	384·4	454·5
51. Polmear, Geo. ..	Friesian..	13	325·4	1	362·1	1	340·3	2	377·1	—	—	4	411·1	11	454·3	32	385·3	454·4
52. Broad, W. A. ..	Jersey ..	15	304·7	4	317·3	—	—	—	—	—	—	—	—	12	480·3	31	374·3	453·3
53. Sage, T. P. ..	,, ..	6	325·9	3	397·9	—	—	4	390·8	1	364·7	—	—	5	437·6	19	382·4	452·8
54. Haywood, Dr. A. R.	,, ..	6	328·9	2	358·1	8	381·6	4	329·5	3	445·4	3	390·5	10	437·1	36	387·2	452·7
55. Medland, F. C.	,, ..	11	324·0	5	350·8	2	338·5	2	351·9	1	407·7	4	430·6	15	430·7	40	382·2	450·2
56. Ross, D. M. ..	Dairy Shorthorn	3	342·6	1	270·1	1	268·1	8	395·2	—	—	1	549·1	3	435·2	17	387·2	449·4
57. Anderson, J., and Sons	Jersey ..	5	402·0	2	278·4	3	420·0	2	452·6	1	390·6	—	—	21	407·9	34	402·6	447·4
58. Beattie, W. P...	,, ..	8	327·7	—	—	1	104·2	3	449·5	2	458·7	2	381·6	8	436·6	24	385·3	445·6
59. Carne, W. J. ..	,, ..	7	319·8	1	380·3	4	394·0	1	515·4	—	—	1	277·0	5	414·3	19	371·5	444·1
60. Davisdon, A. C.	,, ..	1	294·9	—	—	7	354·3	3	384·2	4	401·6	—	—	3	469·6	18	385·7	443·9
61. Lawton, E. and W.	,, ..	6	337·1	2	369·5	5	364·0	1	451·2	4	365·9	—	—	4	394·3	22	367·0	440·5
62. Carson, Mrs. W.	,, ..	10	315·4	3	350·8	5	375·7	5	396·7	3	384·9	1	378·9	14	397·5	41	369·9	440·0
63. Maloney, P. J...	,, ..	9	300·5	4	410·6	2	406·2	1	425·2	—	—	—	—	13	519·1	29	425·2	439·9
64. Peck, R. A. ..	,, ..	6	344·9	—	—	5	346·2	2	402·8	1	393·1	—	—	11	417·7	25	383·7	439·9
65. Vaughan Brothers	,, ..	12	322·9	5	366·4	7	365·7	3	457·8	1	404·2	1	459·6	8	325·7	37	354·3	439·3
66. Ducat, Mrs. F. W.	,, ..	2	378·9	3	378·1	1	426·9	2	302·5	2	308·3	2	457·9	5	420·1	17	385·7	437·3

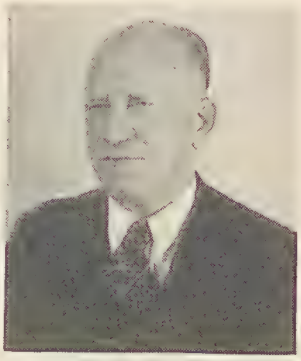
Owner.	Breed.	Junior 2-year-old.		Senior 2-year-old.		Junior 3-year-old.		Senior 3-year-old.		Junior 4-year-old.		Senior 4-year-old.		Mature.		Total Herd.	Average Butter-fat without Allowances.	Average Butter-fat with Allowances.
		No.	Average Butter-fat.	No.	Average Butter-fat.	No.	Average Butter-fat.	No.	Average Butter-fat.	No.	Average Butter-fat.	No.	Average Butter-fat.	No.	Average Butter-fat.	No.		
			lb.		lb.		lb.		lb.		lb.		lb.		lb.		lb.	lb.
Herds of 15 Cows and Over—*continued*																		
67. Ballarat Orphanage	Jersey ..	2	292·2	3	346·9	4	354·7	1	384·1	3	414·9	5	392·9	23	416·4	41	395·4	436·3
68. Hore, A. E. ..	,, ..	3	335·8	—	—	1	368·2	—	—	—	—	—	—	13	429·2	17	409·2	436·0
69. Cox, A., and Sons	,, ..	16	306·8	—	—	5	382·4	6	392·3	4	340·7	3	440·0	11	380·1	45	356·4	435·9
70. Coleman, R. H	,, ..	5	339·0	1	294·7	2	401·3	2	398·8	—	—	1	436·3	4	375·7	15	368·6	435·6
71. Lind, A. E., and Sons	,, ..	4	335·4	4	346·9	3	394·8	2	366·6	2	479·9	1	332·6	5	358·4	21	368·1	434·9
72. Hartley, C. G. ..	,, ..	10	343·5	1	381·6	2	271·2	—	—	—	—	1	404·6	1	276·5	15	336·0	434·7
73. Waterhouse, J. H.	,, ..	8	348·1	3	316·2	2	343·7	—	—	2	367·5	3	420·5	8	393·1	26	367·7	433·2
74. McNabb, G. A., and Son	,, ..	11	305·6	3	332·6	6	325·8	1	550·3	7	341·9	2	502·7	7	409·9	37	354·9	433·0
75. Colenso, L. W. R.	,, ..	4	288·8	2	289·1	2	360·4	1	544·3	2	398·2	1	389·5	13	423·9	25	387·8	432·8
76. Hicks, E. J., and Sons	,, ..	5	317·3	1	383·4	6	354·3	2	391·1	—	—	—	—	4	389·3	18	357·5	431·2
77. Broad, A. J. ..	,, ..	9	274·4	4	345·0	2	332·6	—	—	5	423·6	3	458·5	7	405·6	30	361·6	432·4
78. Boardman, Mrs. E. G.	,, ..	7	290·6	3	380·5	4	363·8	1	486·7	4	331·7	1	322·4	10	423·8	30	366·8	431·0
79. Wilson, A. ..	,, ..	3	293·1	3	325·9	—	—	4	400·3	—	—	2	412·8	9	406·9	21	378·4	426·1
80. Banyule Stud ..	,, ..	7	351·0	4	280·2	1	265·0	2	420·4	1	531·4	1	409·1	8	371·4	24	358·1	425·1
81. Waters, G. L. ..	,, ..	6	371·3	—	—	3	313·0	1	387·4	—	—	1	305·3	10	389·3	21	369·2	421·5
82. Bamford, J. G. ..	,, ..	8	292·5	3	327·7	1	368·7	—	—	2	421·7	—	—	3	387·7	17	335·2	419·7
83. McFarland, R. A.	,, ..	8	283·0	3	283·6	3	395·8	1	331·5	3	424·8	1	323·1	8	403·9	27	350·5	419·4
84. Fairchild and Clutterbuck	,, ..	23	266·4	—	—	5	304·1	3	381·0	6	370·7	1	446·9	13	415·8	51	330·7	419·3
85. Jakobi, L. W. ..	,, ..	5	276·3	2	365·3	3	327·2	2	319·3	2	360·9	1	337·3	14	418·3	29	367·2	417·6
86. Powell, T. S. ..	,, ..	3	361·2	1	413·4	4	377·5	—	—	4	342·0	2	365·7	4	341·2	18	359·5	415·5
87. Young, W. V. ..	,, ..	3	279·9	2	360·5	3	352·3	2	402·2	4	357·8	2	400·2	7	380·0	23	361·4	414·1
88. Webb, A. J. ..	,, ..	7	325·3	2	218·0	3	326·6	3	366·8	3	293·6	5	335·9	20	407·4	43	360·5	413·5
89. Askew, Mrs. S. R.	,, ..	7	347·7	—	—	2	321·8	2	291·4	1	361·6	1	353·6	11	385·8	24	359·1	412·8
90. Handbury, J. E., and Son	,, ..	6	280·7	3	360·1	—	—	2	408·6	1	364·2	1	324·1	6	388·6	19	347·4	412·6
91. Waite, H. M. ..	,, ..	3	313·1	3	357·4	2	312·0	3	301·5	1	436·6	—	—	4	393·6	16	346·9	412·4
92. Hore, R. L. ..	,, ..	5	266·7	2	318·2	1	277·9	1	382·4	3	383·7	—	—	9	410·7	21	356·1	409·5
93. Bickerton, J. J.	,, ..	5	312·8	1	338·5	1	274·6	2	398·2	—	—	3	336·7	14	395·9	26	366·4	408·8
94. Newton, J. M., and Sons	A.I.S. ..	2	322·1	2	268·6	—	—	3	360·3	1	318·3	3	428·0	9	390·1	20	368·8	407·3
95. Ludeman, Lyell C.	Jersey ..	9	297·9	5	304·5	3	310·1	1	360·1	—	—	1	351·1	6	381·9	25	325·5	406·5
96. Khan, G. H. ..	,, ..	12	305·9	4	296·1	4	306·5	—	—	1	359·4	1	318·9	2	329·2	24	309·1	406·0
97. McFarlane, H. E.	Friesian..	3	304·8	—	—	3	356·2	4	343·3	2	362·8	4	356·8	2	382·2	18	348·5	405·6
98. Depart. of Agr.	Red Poll	5	231·1	7	343·7	5	329·3	11	359·9	5	335·2	2	251·3	36	356·6	71	340·6	405·2
99. Pleming, W. H.	Jersey ..	10	312·7	3	299·0	1	441·2	4	354·2	1	258·6	4	359·7	10	354·9	33	337·2	405·0
100. Parker, L. M...	Dairy Shorthorn	7	196·2	1	205·5	3	328·0	2	366·0	2	376·2	2	294·1	13	445·5	30	347·6	402·4
101. Hore, M. T. ..	Friesian..	10	262·1	1	336·7	5	358·5	1	318·1	1	232·4	1	381·5	6	396·6	25	322·5	400·3
Herds of 10 to 14 Cows																		
1. Williams, L. ..	Jersey ..	6	456·3	—	—	1	567·1	2	546·7	—	—	—	—	4	595·6	13	521·6	592·4
2. Ronalds, O., & Son	,, ..	1	396·8	—	—	1	384·3	2	494·9	—	—	1	480·1	5	533·6	10	491·9	525·9
3. Williams Estate, late F. A.	,, ..	3	374·4	2	378·0	1	294·1	1	470·8	2	410·1	—	—	2	590·2	11	422·2	493·1
4. Hearn, Miss I. K.	Guernsey	2	344·6	2	458·2	1	413·9	—	—	—	—	2	516·1	5	458·8	12	445·4	492·1
5. Enders, N. H.	Jersey ..	4	358·9	—	—	3	424·5	1	476·0	—	—	—	—	4	441·2	12	412·5	477·5
6. Murdoch, J., & Son	,, ..	2	313·0	2	351·4	3	337·2	2	470·0	—	—	—	—	2	571·9	11	402·2	474·9
7. Heffernan Bros.	,, ..	5	332·4	—	—	—	—	—	—	3	472·1	1	285·5	5	500·7	14	419·1	472·0
8. Fixter, A. ..	Guernsey	2	379·1	1	381·4	—	—	1	328·3	2	531·4	—	—	6	438·9	12	430·3	470·3
9. Maclean, F. P...	Jersey ..	3	364·5	—	—	3	385·4	—	—	—	—	—	—	6	458·6	12	416·8	466·8
10. Smith, R. A. ..	Friesian..	—	—	1	330·9	1	310·3	—	—	3	452·4	1	548·0	7	454·2	13	440·5	465·1
11. Phillips, F. P...	Jersey ..	2	322·6	2	421·2	1	330·5	1	354·4	—	—	3	413·5	1	578·3	10	399·1	463·1
12. Trewin, J. V. ..	,, ..	1	301·7	—	—	1	501·4	—	—	—	—	3	413·9	5	456·5	10	432·7	458·7
13. Lyttle, A. ..	,, ..	1	229·5	2	359·5	5	389·0	2	364·4	—	—	—	—	4	466·4	14	392·0	452·0
14. Clark, J. E., & F. A.	,, ..	2	304·0	3	312·7	—	—	1	449·4	2	477·6	—	—	6	441·8	14	400·1	448·7
15. Lethlean, R. ..	,, ..	4	374·2	—	—	1	354·5	—	—	—	—	—	—	7	420·6	12	399·6	446·3
16. Devon Park Stud Farm	,, ..	3	287·0	2	372·7	3	436·5	—	—	1	428·5	1	371·9	3	369·5	13	371·2	437·3
17. Barclay, A. H...	Guernsey	4	296·6	—	—	1	372·6	2	381·9	1	497·1	1	438·0	2	385·2	11	366·2	433·5
18. Pearce, A. ..	,, ..	1	257·5	2	314·3	—	—	3	354·4	2	446·7	—	—	3	440·5	11	378·5	431·3
19. Dunmore, T. J.	Jersey ..	1	285·9	2	303·2	1	410·2	—	—	—	—	1	395·4	6	437·5	11	393·0	431·2
20. Felmingham, L. J.	,, ..	4	321·6	—	—	3	452·0	—	—	—	—	—	—	7	380·8	14	379·1	430·6
21. Fraser, G. A., and Son	Ayrshire	4	337·4	—	—	1	391·5	1	487·7	1	332·0	1	393·6	3	340·9	11	361·5	423·3
22. Manson, D. R...	Jersey ..	5	305·7	—	—	2	311·5	3	355·4	2	388·8	2	417·1	—	—	14	345·0	420·7
23. Dowle, A. ..	,, ..	—	—	2	367·7	3	352·3	3	390·3	—	—	1	550·4	5	337·3	14	371·4	417·1
24. Powell, Mrs. K. E.	,, ..	4	255·8	—	—	1	324·2	—	—	2	401·7	1	455·7	3	421·0	11	351·8	411·8
25. Cox, G. and R.	,, ..	3	308·4	3	338·2	—	—	3	339·7	—	—	—	—	4	386·4	13	346·5	411·1
26. Howard, W. C.	Dairy Shorthorn	4	235·8	1	358·2	2	341·6	2	358·0	2	342·9	1	413·5	2	471·2	14	338·7	407·3
27. Withal, H. L. ..	Jersey ..	2	336·3	1	263·6	1	330·1	—	—	—	—	—	—	7	397·2	11	367·9	406·1
28. Flower, R. ..	Friesian..	3	346·5	1	387·5	—	—	1	341·2	1	363·3	—	—	4	335·7	10	347·4	403·4
29. Atherton, W. H.	Jersey ..	2	294·4	3	360·7	3	399·4	—	—	—	—	—	—	5	312·4	13	340·8	400·8

Research Work at Werribee

FARMERS' FIELD DAY

In welcoming the visitors at the Farmers' Field Day at the State Research Farm, Werribee, the Minister of Agriculture, the Hon. A. H. Dennett, M.L.A., said that depreciation of sterling in terms of dollars was an indication that the British Empire was not earning enough to pay for the goods she bought from the United States of America. Now she had to sell more goods than before to earn the same amount of dollars. That state of affairs showed that all was not well, and that it was a paramount necessity to increase production.

Britain was very short of foodstuffs and, in her own interests, Australia must assist the Mother Country to reduce her purchases of foodstuffs from the dollar areas. The call, therefore, went out to every primary producer in Australia to increase his production to the maximum, despite the obvious difficulties with which he was confronted, and which, to some extent, frustrated his efforts.



The Minister of Agriculture; The Hon. A. H. Dennett, M.L.A.

Fortunately, there was available for the use of the man on the land a wealth of scientific information provided by the Department of Agriculture and organizations like the C.S.I.R.O. It was true that many primary producers were thoroughly efficient and had adopted all proven scientific methods that were available to them, but it was equally true that many had done so only partially, and others even to a lesser extent.

The Department of Agriculture was spending approximately £430,000 a year on research extension and agricultural education for the benefit of the man on the land.

Recently a drive had been launched by the Department to stimulate increased dairy production to supply the Mother Country with much needed butter, cheese, and other milk products. To this, the Commonwealth Government had made a substantial financial contribution. Evidence of this activity could be seen everywhere through the dairying districts in the technical posters that had been prepared and distributed to all butter and cheese factories.

An additional mobile film unit, especially for use in the dairying districts, had been purchased and is in operation, and as soon as the equipment can be purchased and assembled a new mobile better-farming unit, with lecturing staff and technical exhibits, will bring to Victorian dairy farmers the latest scientific information available.

One of the limiting factors to increased production was the shortage of trained technical officers with a first-class knowledge of the farmers' problems and their solution. The Government had recognized this disability and had provided a number of scholarships at the Sydney University in order to increase the supply of trained veterinary officers.

Scholarships are also being provided to enable promising young Victorians to proceed to the Massey Dairy Research Institute and College, New Zealand, so that the technical staff of the Dairying Division could be built up.

Under the Agricultural Education Act passed last session the University would set up a course in animal husbandry to train graduates in agricultural science especially to assist the live-stock industry of the State.

An animal research centre would be set up at the State Farm, Werribee, and, in order to have the latest information on the subject, Mr. D. Wishart, Veterinary Officer, whose work with artificial insemination was well known, had been sent abroad and was now in the United States. On his return at the end of the year a start would be made on this project. The University would co-operate with the Department of Agriculture in the work of this new laboratory.

In addition, the Government had purchased a splendid site at Terang for a dairy college. At this centre research into animal and crop production problems would be undertaken. A similar institution would be set up in Gippsland.

The Director of Agriculture, Mr. H. A. Mullett, said that the total value of primary production had now reached £146,000,000 per annum. Of this sum, £116,000,000 worth was exported.

Primary produce constituted 90 per cent. of the exports of the States, and, therefore, the economic solvency of the State was closely bound up with the efficiency of primary production. The problem of increasing that efficiency was one of great complexity, not only because of the number of industries concerned, but also because of the different conditions which existed in the various parts of the State.

To assist in solving the problems of the man on the land, the State had set up a chain of research farms which were being added to from time to time. There was the Central Research Farm, Werribee, the State Experiment Farm at Rutherglen, the Mallee Research Farm at Walpeup, the Horticultural Research Station at Tatura, and recently two new farms had been established—one, a Potato Research Farm at Toolangi, and the other a Horticultural Research Station at Scoresby.

Extensive experimental work was also carried out by the Department at the Dookie and Longerenong Agricultural Colleges. These colleges will be supplemented by a dairy college at Terang, at which research into animal husbandry problems, and into crop production, will be undertaken.

In addition to the work carried out on these farms, a large number of experimental plots had been established on private farms where research and investigation were undertaken in co-operation with local farmers. In this way the problems on varying environments were being attacked.

The conduct of agricultural research and investigation requires patient work over many years, but once a research station was established on sound lines, and properly staffed, it was like a fruit tree—slow to come into bearing, but once it began to bear it yielded fruit each year.

The State experiment farms oi Vfctoria had a proud record because they could point to achievements which have been responsible for placing many millions of pounds into the pockets of the farmers, and so adding to the prosperity of the State generally.

The State Research Farm, Werribee, Mr. Mullett continued, was the principal wheat-breeding centre, and today, wheats bred there occupy 90 per cent. of the three million acres sown annually to wheat in Victoria. This was a record that could not be bettered anywhere else in Australia or even abroad. It is safe to say that these cross-bred wheats have increased the State's yield by at least 2 bushels an acre, as compared with the wheats which they originally displaced. At 10s. a bushel this increased yield was worth £2,700,000 per annum.

The technique of sowing and managing first-class irrigated pastures was first worked out at the State Research Farm, Werribee, and, today, pastures of this type that would carry a cow to the acre were sown on more than 200,000 acres in the irrigation districts throughout the State. This revolutionized irrigation practice which, until that time, had been largely dependent upon lucerne, which, on many of the soils, was neither very productive nor enduring.

In 1912, at the State Research Farm, Rutherglen, experimental work on natural pastures showed that it was possible to substantially increase their productivity by relatively small dressings of superphosphate. Today, in this State, five and a half million acres were being top-dressed annually with superphosphate, but the area which was top-dressed at wider intervals was more than double that acreage.

These were only the highlights of the work that had been done. The full story, however, was set out in the Guide Books issued in respect of each Station.

CROP ROTATION

Discussing the permanent crop rotation trials, Mr. W. B. Miller, M.Agr.Sc., Senior Inspector of Agriculture, pointed out that permanent agriculture was dependent on the maintenance of soil fertility which, in turn, was affected to a considerable extent by the system of crop rotation practised. In general, grain farming tended to deplete fertility while live stock farming based on pastures, tended to build fertility provided that phosphate deficiencies were remedied by the use of fertilizers.

The Permanent Rotation Field had been established 36 years ago to compare various crop rotations at Werribee, and to provide a scientific basis for the study of long-term changes in soil fertility.

The outstanding results and conclusions reached from 35 years of the trials are :—

(1) Periodical fallowing is essential to maintain yields, conserve moisture, and control weeds.

(2) The most profitable of the rotations tried has been fallow-oatenhay-barley. The average yield of hay in this rotation, 44·9 cwt. per acre, is more than twice that of hay grown continuously—23·4 cwt. per acre. Peas and rape have proved unsuccessful and uneconomic for inclusion in the crop rotation at Werribee.

(3) Wheat yields have been higher in the rotations which include a year of pasture, i.e., where animals grazing are a feature of the farming system, than in the narrow rotation of fallow-wheat.

(4) In the fallow-hay rotation, yields have steadily decreased during the period of the trial, at the average rate of ·56 cwt. per acre per year. In the other rotations, no significant trend in yield, either up or down, has been recorded.

(5) As judged by soil chemical analyses made periodically, soil fertility has been maintained best where pasture has been included in the rotation. It has declined appreciably in the rotations fallow-hay and fallow-hay-barley.

Further experiments have been initiated to determine the practicability at Werribee of including subterranean clover in the crop rotation programme.

ESTABLISHMENT OF IRRIGATED PASTURES

Mr. A. Morgan, B.Agr.Sc., Senior Irrigation Officer, told visitors that, although the seeds mixtures for irrigated perennial pasture might be varied considerably according to soil and irrigation water supply conditions, the one which had been favoured at the State Research Farm was :—

Perennial rye grass ..	12–14 lb./acre
Cocksfoot	3– 5 ,,
White clover ..	1– 2 ,,
Red clover	1– 2 ,,
Alsike clover ..	1– 2 ,,
Strawberry clover ..	¼ ,,
Subterranean clover ..	1– 2 ,,
Total	20–27 lb./acre

Prairie grass (2 lb./acre) or lucerne (1 to 2 lb./acre) might be included.

As the pastures age, and particularly where low-lying areas develop, due to subsidence of the land, Paspalum dilatatum becomes an appreciable contributor to the summer production.

The times of sowing which give best results are the autumn or spring, and at least one bag of superphosphate per acre should be mixed with the seed immediately prior to sowing. The seeds are small and

Harvesting plots, permanent rotation field, State Research Farm, Werribee.

need to be sown shallowly, not more than half an inch of covering soil being recommended.

Irrigation of young pasture should be given when required to maintain vigorous growth, and grazing should be light, avoiding all possible damage to the seedlings by the introduction of heavy stock too soon after rain or irrigation. In the case of wet winter or spring conditions which prevent grazing, a mowing should be done before the rye grass becomes too aggressive and begins to smother the clover species.

The annual topdressing with superphosphate should be at least 4 cwt. per acre.

With careful management of these operations, and avoidance of over-grazing, the pasture should, in a few years, reach a carrying capacity of a cow to the acre on average soil.

On the subject of irrigated annual pastures, Mr. Morgan stated that the role of these annual pastures was most important in districts with low water rights. In these cases, they were conveniently and profitably grown to provide autumn and spring feed while lucerne paddocks were at a low level of production. The most valuable pasture type for this purpose was the Wimmera rye grass-subterranean clover mixture sown in the autumn on graded land with from 4 to 8 lb. of rye grass and 1 to 3 lb. subterranean clover per acre, with or without a cover crop of oats or barley. The certified strains of subterranean clover suitable to irrigation are Mount Barker, Bacchus Marsh, and Tallarook. The two former give the greater bulk of winter feed.

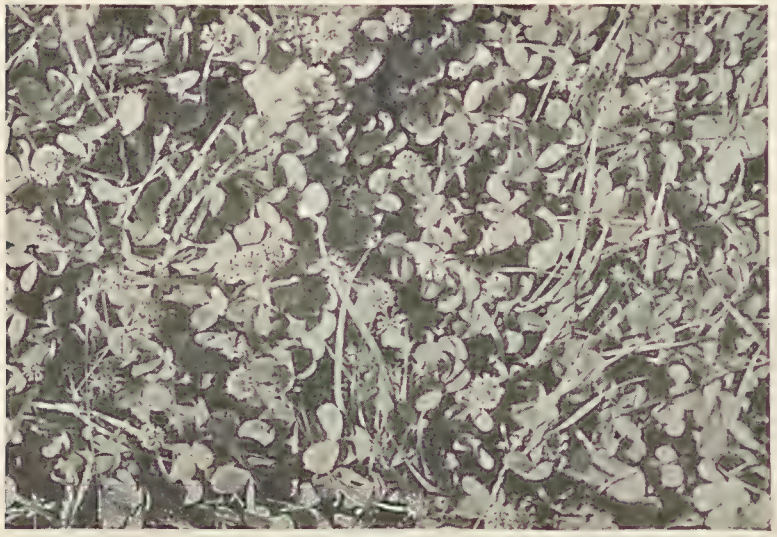
A bag of superphosphate per acre is recommended at seeding and annually thereafter and may conveniently be applied in the late autumn or early winter.

Failing suitable rains, irrigation to germinate the pasture should be given at the end of February. According to conditions, one or two additional irrigations should be given in the autumn and one or two in the spring, discontinuing irrigation about mid-October.

Grazing should commence on the older pasture when the summer perennial pasture growth has dwindled and may be continued until the seeding of the Wimmera rye grass is advanced.

The benefits or otherwise of cultivation of annual pasture are to be investigated, also the relation of such cultivation to the control of barley grass. Minor element requirements are to be studied, and the minimum water-usage consistent with satisfactory growth is to be ascertained.

Heavy rains which can occur in December or January may cause too early germination of the subterranean clover. Under these conditions the irrigator must determine for himself, on his own assessment of the probable future weather conditions, whether or not to continue to irrigate.



Irrigated pasture at Werribee, showing rye grass, prairie grass, and white clover.

The quality of the hay from this type of annual pasture is high when cutting is done in the spring before the Wimmera rye grass seeding is advanced, provided suitable conditions for haymaking are encountered.

IRRIGATED PERENNIAL PASTURES

Dealing with the results of irrigated perennial pasture experiments, Mr. G. B. Rayner, B.Agr.Sc., District Agricultural Officer, said that, since 1926, the area of irrigated pastures in Victoria had increased steadily, and was now over 200,000 acres.

Some of the Research Farm pastures were over 30 years old, demonstrating their longevity. In addition, their productivity under sound management improved with age. Sound management involved particular attention to irrigation methods and manurial treatment and these factors had been investigated in detail.

Intensively grazed pasture at Werribee. This pasture, which is growing on heavy clay loam, consists of perennial rye grass, Kentucky blue, cocksfoot, white clover, and strawberry clover.

The Werribee investigations demonstrated that, irrespective of the watering treatment, the application of superphosphate alone was the best manurial practice. The amount of superphosphate which could be applied with profit was shown to be related to the amount of water applied and the frequency of its application. Under frequent watering, progressive increases in yield were obtained up to 4 cwt. of superphosphate per acre, but the pasture given less frequent watering failed to take advantage of the additional manure. An increased rate of application of superphosphate promoted the development of white and strawberry clover at the expense of subterranean clover; this was most marked on the frequently-watered plots. The fewest weeds and the least amount of bare space were found in the plots most heavily top-dressed and watered at frequent intervals.

Approximately half of the irrigated area of Victoria is on soils comparable with those at Werribee and the results of these trials are therefore of wide application.

Discussing grazing trials on irrigated perennial pasture, Mr. R. H. Beattie, B.Agr.Sc., Field Agrostologist, stated that, under irrigation, much greater numbers of stock can be carried than was usual under normal dry farming conditions. The density had been shown at Werribee to reach ten to fourteen sheep per acre throughout the year, according to the season.

When rotational grazing was practised with alternate grazing and resting of the pastures, the density per acre of the sheep population was substantially increased and new problems arose, especially if numbers as high as 70 sheep per acre were placed on a field for short periods, as can readily be done.

There are two main problems:—

(1) The effect on the pasture and the species.

(2) The effect on the sheep, particularly from the point of view of re-ingestion of animal excrements, the spread of worm infestation, entero toxaemia, pregnancy toxaemia, and foot rot.

In order to study these problems, an intensive rotational grazing trial was undertaken in 1937. The grazing frequencies employed were:—

(1) Five days grazed five days spelled.
(2) Five days grazed fifteen days spelled.
(3) Five days grazed 25 days spelled.
(4) Five days grazed 35 days spelled.

This test showed that the frequency of grazing under these conditions did not greatly influence carrying capacity and botanical composition, seasonal conditions being more important. However, the five days grazed and 25 days spelled section gave a high carrying capacity coupled with a minimum of waste due to fouling and trampling of stock.

The cereal laboratory, State Research Farm.

At the beginning of July this year, the trial was again modified to test rotational grazing (five days grazed and 25 days spelled) against continuous grazing in regard to the factors outlined above.

Complementary trials, in which the numbers of stock were varied according to pasture growth, were commenced in 1931 on a thinned-out lucerne stand converted to perennial pasture to ascertain the optimum concentration of breeding ewes to be carried all the year round. Supplementary feed was given during the winter period and the amounts eaten were recorded.

Over a period of years, eight lambing ewes per acre were maintained in good condition using grass hay made from the same area. The amounts consumed varied with seasonal conditions from one-third to two-thirds of a pound of hay per head per day.

An average of 80 per cent. good-quality lambs was marketed at profitable prices, and heavy fleeces of good quality were shorn.

RESULTS OF CEREAL BREEDING

In an interesting talk on cereal breeding, Mr. A. R. Raw, M.Agr.Sc., Senior Cereal Geneticist, said that one of the most important and extensive aspects of the cereal research work being conducted at Werribee was the breeding of improved varieties of wheat, oats, and barley. Plants are bred in much the same way as animals, said Mr. Raw, and parent types were chosen because of desirable characters exhibited. These are mated with the object of combining the desirable characters of both in the progeny.

The main basis for all breeding work was yielding ability, because a variety which did not possess this characteristic was of no value to the farmer. In the case of wheat the new variety must also produce grain of good milling and baking quality, and must be able to resist disease and drought. A new oat must be suitable for hay or grain production, or for grazing, while, in the case of barley, malting quality was of great importance.

During the period in which the cereal breeding work has been in progress at Werribee, the Department of Agriculture has named and distributed to farmers 27 new wheats, 4 oats, and 1 barley.

Of the varieties named, the most important are the wheats Quadrat, which last year was grown on 47 per cent. of the wheat acreage of Victoria; Pinnacle, which because of its yielding ability, good grain quality, and resistance to flag smut, is becoming very popular in the Wimmera; and Insignia, the New Mallee wheat. Algeribee oat, superior to the parent variety, Algerian, in both hay and grain yield, is rapidly replacing that variety as the standard oat of the State, while Research barley, because of its yielding ability and the excellent malting quality of its grain, is widely grown in the southern districts of Victoria.

Some idea of the value of the breeding work to the farming community and to the State as a whole may be gained from the fact that at the present time 90 per cent. of the Victorian wheat area is sown with wheats bred by the Department of Agriculture.

Dealing with the subject of breeding for disease resistance in cereals, Mr. P. H. Debrett, B.Agr.Sc., Assistant Cereal Geneticist, pointed out that plant diseases take a toll of cereal crops in Victoria every year. Broadly speaking, these diseases fall into three main groups—rusts, which attack the stem and leaves; smuts, which are mainly confined to the ears but may also attack the growing plant; and footrot, which affects the basal portion of the plant.

One of the most important aspects of the cereal improvement work was the breeding of high-yielding varieties which were capable of resisting the attacks of these diseases.

Particular attention is being paid to rust, which, in some years, has been responsible for enormous losses in yield, and in extreme cases total failure of the crop.

A number of varieties of wheat and oats immune from the attacks of rust have been obtained from U.S.A., Canada, and South Africa. Unfortunately, these are not suitable for cultivation under Victorian conditions, but they are being used in the breeding programme to combine their rust-immune qualities with the high-yielding ability of local wheat and oat varieties. A large number of crossbreds is at present under test, and the most promising of these will be included in yield trials next season.

Another aspect of the work is the breeding of wheat varieties resistant to flag smut. This disease, which was very prevalent in the Mallee, cannot be controlled by artificial means, and the only solution to the problem is the use of resistant varieties. In this regard the breeding work at Werribee has been very successful, and many of the newer wheats are highly resistant to flag smut, the most notable of these being Quadrat and Pinnacle.

FERTILIZER TRIALS WITH CEREALS

The manurial needs of cereals were discussed by Mr. J. Crook, B.Agr.Sc., Science Field Officer. These requirements, said Mr. Crook, vary with the crop and the environment, and to ascertain the most economic kind and quantity to apply, reference must be had to accurately-conducted experiments. In the Permanent Manurial Field on the Research Farm and in allied trials which have been conducted in other fields on the farm over the past 32 years, aspects of the manurial problem as it applies to cereal crop production have been investigated, and the results obtained furnish a very accurate picture of the manurial requirements of the three cereal crops—wheat, oats, and barley—in the Werribee district.

In general, the manurial trials on fallow land have indicated very clearly the need of superphosphate for the successful production of cereal crops in the district, and, in that respect, they confirm the Department's work in all cereal-growing areas of Victoria.

The results of the trials on fallow may be summarized as follows :—

(1) Superphosphate is normally the only fertilizer required with cereal crops sown on fallow.

(2) The quantity of superphosphate giving the most profitable results is from 1 to 1½ cwt. per acre, the greater quantity being required where the land has not been liberally fertilized for a recent crop.

(3) No profitable increase has been given either by nitrogenous or potassic fertilizers or by lime, except that, in cases where the crop is sown on weedy fallows after heavy autumn rains, sulphate of ammonia added to superphosphate is profitable.

For cereal crops on stubble land, the manurial requirements are different from those grown on fallow. Here the crop benefits from the residues of the superphosphate applied during the previous season, and the response of stubble-sown crops to this manure is almost negligible. The application of nitrogenous fertilizers to stubble crops usually results in a large increase

Typical heads of Quadrat. This wheat, last year, was grown on 47 per cent. of the wheat acreage of Victoria.

in yield, and the most profitable results are obtained from a dressing of 2 cwt. per acre of a 1 : 1 mixture of superphosphate and sulphate of ammonia.

POULTRY FEEDING TRIALS

The poultry expert, Mr. M. D. Hall, discussed the poultry feeding tests. These have been conducted at the State Research Farm, Werribee, since 1921 with Australorp and White Leghorn pullets intensively housed.

The purpose of the tests has been to find a feeding ration most suitable for the health and egg production of laying fowls. The rations varied considerably, and many substitutes were included to replace some of the regular foodstuffs used on commercial poultry farms.

It was found that crushed grain can be supplemented for pollard.

Comparative tests have been made with meatmeal and buttermilk, and the results showed that both were equally suitable as a protein constituent of the ration.

Tests were made with rations containing various quantities of meatmeal and, in this case, the highest production, and also the highest profit over food cost, was obtained in the pen fed with 7½ per cent. meatmeal.

Vitaminized oils proved to be a reliable substitute for greenfeed. The health and production of the birds was good and no avitaminosis was reported. The yolks of the eggs laid by these birds were paler than the yolks of those receiving greenfeed.

Free choice whole grain and meatmeal fed in separate hoppers proved to be a suitable substitute for bran, pollard, and meatmeal.

Egg production was usually highest when the grain was fed in the litter rather than in hoppers.

Greenfeed is essential for health and egg production, but nothing is gained by feeding excessive quantities.

To summarize the tests, it was found that hens lay well on a large variety of different foodstuffs, rations, and methods of feeding.

Egg yields increase or decrease with the quantity of food consumed.

The feeding of either wet or dry mash gives higher egg yields than the feeding of free choice meals or soaked grain.

Meatmeal as the only protein supplement has been the most satisfactory. The best ration is a mash containing approximately 10 per cent. of meatmeal and whole mixed grain with greenfeed and shell grit.

At Werribee, sufficient variety has been provided by the grain mixture, usually 2 to 4 parts of wheat and 1 part each of oats, barley, and maize.

Vitaminized oil and extra minerals, such as phosphate, iodine, and iron were unnecessary in rations comprising standard wet mash (pollard, 60 lb.; bran, 30 lb.; meatmeal, 10 lb.), mixed grain, greenstuff, and shell grit.

RED POLL AND FRIESIAN CATTLE

Speaking on the subject of breeding and feeding cattle, Mr. A. C. T. Hewitt, M.Agr.Sc., Live Stock Science Officer, said that the Department of Agriculture had been breeding Red Poll cattle for 40 years to improve the production and utility points—easy free milking, well-shaped udders with nicely-shaped teats of convenient size, and fattening propensity. The foundation period was from 1909 to 1914, during which time 105 cows and four bulls were purchased.

Thirty-five of the original 105 foundation cows were culled before being bred from, and gradually other poor-producing or poor-breeding cows were eliminated. The present herd includes direct descendants of only ten of the original 105 foundation cows.

The stud had been herd-tested since its inception, and the conditions of the Standard Herd Test were originally based on the information gained in the early testing of this stud. It had not been possible to buy proven sires and all bulls have been progeny tested in the stud. Bulls have been purchased on the productive performances and appearance of their parents and near relatives.

Until the introduction of Woodburn Peter Pan, the breeding system was one of outcrossing and inbreeding with the foundation bulls. Woodburn Peter Pan was an outcross and the use of Burnwood Masterpiece and Naranghi Master has been inbreeding to his blood lines. For over 30 years the "Victoria" Red Poll stud has been the best for its size in the world.

The breeding of the Friesian herd had been similar, except that the foundation cows were selected for high production from the New Zealand Government in 1917 and much less culling had been necessary. Outcrossing and inbreeding have been alternated in the selective breeding of this stud, which has been the leading Friesian herd in Australia for many years.

In the milking shed, State Research Farm.

The dairy herd foreman, Mr. S. Gale, said that, in the Friesian herd, the proven sire "Terling Hypothesis" (Imp.) was leaving some outstanding producers. Nineteen of his daughters, tested to date, have an average butterfat yield of 490·8 lb. (mature equivalent). The dams of these daughters averaged 464·7 lb. (mature equivalent).

"Victoria Olga," the champion Standard Herd Test cow this year, produced 905·3 lb. of butterfat from 25,353 lb. of milk. During the 273-day test this cow yielded an average of 92·8 lb. of milk daily. Her average butterfat yield for four years is now 637 lb. "Olga's" dam, "Victoria Rita," has commenced her tenth lactation and was yielding up to 113 lb. of milk daily. She produced 63¼ tons of milk in nine years, her average butterfat yield for that period being 524 lb.

The leading Red Poll sire, "Burnwood Masterpiece," now thirteen years old, had proved to be a sire of producers. His 45 daughters, tested to date, had an average butterfat yield of 405·3 lb. (mature equivalent), while the dams of these daughters averaged 388 lb. of butterfat (mature equivalent).

Victoria Olga, Champion Standard Herd Test Cow for 1948-49 produced 905·3 lb. butterfat.

"Victoria Electricity" holds the world 273-day butterfat record for the breed with 777 lb. On her last test, recently completed, she produced 693 lb. of butterfat. Now on her eighth lactation, she has an average butterfat yield of 539 lb. for seven years. Her dam, "Victoria Volt," averaged 443 lb. of butterfat for eleven lactations.

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Oriental Peach Moth Spraying Trials in the Goulburn Valley

Progress Report

By D S. Morris, B.Agr.Sc., Assistant Entomologist, Biological Branch, Department of Agriculture

THE following paper on Oriental Peach Moth Spraying trials in the Goulburn Valley last season is issued in the nature of a progress report. The pest has caused considerable loss to growers of late-maturing peaches in the Goulburn Valley for many years, and during the past season DDT and the new insecticide E.605 (diethyl para nitrophenyl thiophosphate) were used against it in a block of Golden Queen peaches at Shepparton East. Late varieties such as Golden Queen are most susceptible to damage by this moth.

The four treatments (Table 1) were replicated three times throughout the block, and this also applied to the control plots.

In the original spray programme it was intended to have included an early spray, but owing to the unsuitable weather conditions encountered at the time, this early application was omitted from the schedule.

Sprays were applied immediately following the peak of moth emergence as indicated by lure moth catches.

The results (see Table 1) on analysis show all four treatments to give a significantly lower infestation than the control plots. Between the treatments there was no significant difference, although the difference between Treatments 1 and 4 approached significance.

It appears that late applications are important in reducing the level of infestation, as it is the larvae hatching from the eggs laid by the later broods of moths which are responsible for most of the entries in the fruit. Most growers, however, find difficulty in applying late sprays to peaches, as they are usually engaged in the harvesting of earlier-maturing peaches and the bulk of the pear crop.

TABLE 1.—SHOWING DAMAGE BY ORIENTAL PEACH MOTH TO GOLDEN QUEEN PEACHES.

Treatment.	Total fruit for treatment.	Number of moth-infested peaches.	Percentage Oriental Peach Moth.
No.			
1—1 mid-season + 2 late sprays of 0·05% E.605	5,144	311	6·1
2—1 mid-season + 2 late sprays of 0·1% DDT	4,054	156	3·8
3—1 mid-season + 1 late spray Jan. 7th of 0·1% DDT	4,301	242	5·6
4—2 late sprays of 0·1% DDT	4,813	162	3·4
Controls	4,299	482	11·2

Times of Application.	Difference for significance.
Mid-season spray—Nov. 27th, 1948 1st late spray—Jan. 7th, 1949 2nd late spray—Feb. 10th, 1949.	At 5% level, 4·16 At 1% level, 6·05

From this season's work, both DDT and E.605 show promise in reducing the damage caused by the Oriental Peach Moth. Next season it is proposed to continue the trials.

Acknowledgments

The author acknowledges, with appreciation, the co-operation of Mr. L. Pithers, on whose property the trials were conducted, and also the assistance rendered by Mr. C. Bullock, Orchard Supervisor, Shepparton.

LIVE STOCK NOTES

Compiled by A. C. T. Hewitt, M.Agr.Sc.,
Live Stock Science Officer

These young Aberdeen Angus cattle coming off lush pasture, relish a feed of grass hay.

GRASS HAY HARVEST

FARMERS throughout Victorian pastoral areas are checking over and oiling their hay-making machinery in preparation for the coming harvest. Probably the long dry winter and doubtful seasonal prospects up to the beginning of September were a forcible reminder that every blade of surplus grass for hay should be conserved as an insurance against another drought.

Since last year stock numbers have increased, and it might well prove disastrous for stockowners to be caught without food for so many sheep and cattle after rebuilding their flocks and herds after the previous drought.

In considering grass hay, it is well to remember the importance of quality. To produce the best hay it should be cut before the grass is mature, cured rapidly, and carted in before there is any spoilage by the weather.

The practice of rotational grazing on one Gippsland farm has enabled the owner to shut up four of his ten paddocks for grass hay. These paddocks were grazed out at the end of August and harrowed just before the early September rains.

Ninety to 120 tons of grass and lucerne hay may seem a large quantity to conserve for a herd of 45 cows, but this amount is conserved and fed each year by leading dairy farmers. It is the quantity stacked and used each year by a dairy farmer in the Sale district whose herd of 45 cows has been averaging 350-lb. of butterfat on rations of pasture and grass hay only.

England needs more butter, more cheese, and more of the other milk products. To produce such products in greater quantity cows need to be fed better; and to feed them better conserved fodder is needed to supplement paddock feed as it dries off. More meat can be produced in the same way.

[A.C.T.H.]

NO HAND-STRIPPING

The Department of Agriculture has received a copy of Dr. W. E. Petersen's new film, "No Hand-stripping," which is now available

for screening throughout the dairying districts of Victoria. Dairy farmers already know of the splendid work done by Dr. Petersen of the University of Minnesota, U.S.A., through his earlier film, "The Science of Milk Production," and his lectures on "Milking Management" when he made a brief tour of eastern Australia last December.

In his new technicolor film, Dr. Petersen amplifies five points for thorough machine milking, with very clear, concise explanations. Readers who saw the earlier film will remember these five points, namely:—

1. No disturbance to upset the cow when in the milking shed.

2. Proper stimulation to enable her to "let down" the milk.

3. Operating machines in accordance with the manufacturer's instructions.

4. Machine stripping and total avoidance of hand stripping.

5. Removal of the machines as soon as the milk flow ceases.

Enquiries concerning the screening of this film should be made to the Director, Department of Agriculture, Melbourne, C.2. Organizations whose members have not seen the first film "Science of Milk Production" are advised to arrange for a screening of that film before asking for "No Hand-stripping."

[A.C.T.H.]

PROBLEMS WITH PURCHASED STORE PIGS

At pig sales in the past few months store pigs have been in demand, and many farmers have not been able to obtain sufficient to satisfy their needs. In some instances, when they have been able to buy, the pigs have developed diseases very soon after arrival on the new property. The financial losses have been fairly severe in most instances due to deaths, poorer growth rates of survivors and insufficient pigs to consume available food. To overcome problems such as these, farmers should consider breeding their own pigs.

In selecting sows for breeding, it is desirable to know something of their background. If possible, details of their breeding should be obtained and preference given to pure-bred or first-cross sows. Crossbred sows often prove excellent mothers. A sow from a large litter which had a heavy weaning weight should be better than one from a small litter. Weight-for-age is important, and therefore it is desirable to know the age of the sows selected, so that preference can be given to those which have grown to bacon weight quickly.

The best method of judging a bacon pig is to kill it and appraise its carcass, but in the live pig all we can go on is its external shape. Pigs with light shoulders, long middles and meaty hams are preferred, and especially if its litter mates have been found to be good baconers by carcass appraisal. The prospective brood sow should have twelve or more well-developed and well-spaced teats.

In most instances, satisfactory results can be obtained by mating young sows when they reach 250 lb. live weight.

The biggest costs involved in carrying a baconer weight sow on to a breeder is feed. In most dairying districts sows are placed in paddocks which generally have some grass on them. In addition each sow would need half a gallon of skim milk or its equivalent, plus grain, to keep her in good condition. With good pasture, not more than 4 lb. of grain should be required daily by any dry sow.

In most cases it would be much cheaper to breed pigs than to buy stores in the spring.

[A. D. North, B.Agr.Sc., Science Field Officer.]

VITAMIN B12

A new vitamin named the "animal protein factor" or vitamin B12 has been discovered in cow manure and the livers of ruminants. Pigs gathering undigested grain from the droppings of cattle are said to thrive so well because they take in some of this vitamin. The merest trace of vitamin B12 is said to be sufficient to enable pigs to thrive on vegetable proteins and to dispense with the necessity of feeding protein-rich foods of animal origin such as meat meal or skim milk. These foods have been in short supply for many years now and feeders would welcome some inexpensive supplement which would eliminate the need for animal protein in pig raising. The need for animal protein in the rations of poultry is also reduced if this vitamin is supplied.

A more interesting feature is that the absence of this vitamin appears to be the cause of pernicious anaemia in humans, and persons treated with the chemically pure crystalline form of the vitamin have responded favourably as they have done when on the liver treatment.

The vitamin is not available in commercial quantities and the small amounts which have been extracted are very expensive to produce, nevertheless research is progressing and it appears that if cattle livers are soaked in solutions of cobalt salts for a few days, large quantities of the vitamin are produced which can be dried in the livers and marketed in the ground liver meal.

The chemically pure vitamin B12 is a red crystalline substance containing nitrogen, phosphorus, and cobalt.

[A.C.T.H.]

WEIGHING CHICKS

The person who succeeds in poultry farming is usually endowed with keen observation and sound judgment. Capable of recognizing the very early symptoms of illness and other troubles, he quickly applies measures of control that prevent complaints like coccidiosis, common cold, false moult, and lowered egg production, from reaching alarming proportions. Most complaints are preceded by loss of appetite and lassitude and when a close watch is kept for these symptoms the extent of the trouble can be reduced.

An enormous amount of valuable information can be obtained by weighing poultry, particularly day-old chicks and young growing stock at regular intervals. A reliable set of scales is a wonderful asset to poultry farmers, and groups of chicks from every hatch should be weighed, preferably 100 per group, as a check on breeding stock and incubation.

The weight of 100 normal day-old chicks hatched from 2-oz. eggs is approximately 9 lb. This would vary according to the size of the egg used for incubation, but with standard-weight eggs any consistent drop in weight of chicks should be the sign to take immediate steps to discover the cause. Some breeders can tell the quality of chickens by their appearance or by handling, but the safest check on progress is obtained by weighing them.

An underweight chick is a weak chick and if this is known before the chickens are placed under the brooders it would solve many perplexing problems that are often wrongly attributed to brooding.

Weighing should continue during the rearing period at approximately four-weekly intervals.

Although weights vary according to strain, every breeder should know the average weight of his own particular strain of birds at various ages. The following are the approximate weights of chicks at different ages :—White Leghorn and Australorp, 1-day old, 1·3 oz. ; 4 weeks, White Leghorn, 7·6 oz. ; Australorp, 8·7 oz. ; 8 weeks, White Leghorn, 20·4 oz. ; Australorp, 25·3 oz.

The poultry farmer will be weighing samples of birds from each group or batch which he is rearing and as he weighs the samples collectively the weight of samples rather than individuals will be more easily followed. One hundred chicks either Australorp or White Leghorn should weigh 9 lb. and the weights of 20 chicks at 4 weeks old are 8¼ lb. for White Leghorns, and 11 lb. for Australorp, and at 8 weeks, 25½ lb. for White Leghorn and 31½ lb. for Australorp.

If loss of weight is general through the flock and consistent in all age groups, there is need for investigation into all phases from the breeding stock through incubation to rearing, feeding and management, but if the loss is due to a number of backward individuals only, and is not spreading through the flock, it is logical to assume that the strong, robust chicks are the progeny of sound breeding stock, correctly incubated, and properly fed.

[M. D. Hall, Poultry Expert.]

BEEKEEPING

In some localities hives are still very weak, and losses through starvation have also occurred. This is due chiefly to the adverse weather conditions last autumn when bees were unable to store sufficient well ripened honey for their winter and early spring requirements. Where feeding is still necessary to keep hives going, sugar syrup—2 parts of sugar to 1 of water fed while warm—may be used. Sugar for feeding bees is in short supply and, if practicable honey should be used, preferably low-grade

honey from banksia. Where honey is used, care should be taken that it originated from hives and equipment free of disease.

Spring examination of the hives should be made to see that each has at least 12 lb. of honey—according to their strength—to tide them over a break in the weather. When queens commence to lay and establish or expand the brood nest, bees will consume stores quickly in feeding larvae, unless honey is coming in freely.

If the brood nest is congested with stores, room should be made for the queen by putting an empty good worker comb beside the brood nest. It is also as well to scrape the cappings off the honey around the brood. This causes the bees to move the honey thus making room for the queen to lay.

Failing queens should be replaced immediately, and queens slow to expand with good spring conditions should be kept under observation and if doubt exists as to their quality they should be replaced.

All sealed broods should be closely examined for disease, and if any symptoms of "foul brood" such as darkened, sunken, or perforated cappings, are found, the hives should be closed up again immediately, and the Chief Veterinary Inspector, Department of Agriculture, Melbourne, notified immediately. Great care should be taken if comb exchange or hive re-location is carried out to see that disease is not spread through the apiary. Comb exchange or hive re-location is not advisable in an apiary where disease is known to exist.

The swarming period is approaching and now is an opportune time to prepare for it by boiling down old combs and fitting sheets of foundation to the frames so that a good supply will be on hand when it is required. Prevention of swarming is better than cure and much swarming can be avoided if hives have young queens, are not allowed to become congested, and the hives are given as much foundation as they can work on.

[C. D. Ilton, Apiary Inspector.]

CHICKEN REARING

Ultimate success in producing the best laying stock depends largely on careful rearing of the chickens, especially during their early life.

There are several systems of artificial brooding of chickens, such as the battery, hot-water-pipe system, electrically heated hovers, and those heated by kerosene lamps. Those of the hover type, electrically operated, have given every satisfaction.

Ideal conditions in rearing are obtained when the chickens are allowed a certain amount of freedom in healthy surroundings. This is provided by the use of open grass runs in front of the brooder house, and subsequently rearing in colony houses on free range, as soon as the chickens can do without artificial heat, which is approximately at four to six weeks of age depending largely on the weather.

Brooders and brooder compartments should be thoroughly cleaned and disinfected before use, and the utmost cleanliness is essential in all subsequent operations. Rice hulls on the floor to a depth of one to two inches are ideal as litter for the chickens.

During brooding, chickens should be kept at the correct temperature for comfort, approximately 90 degrees Fahrenheit for the first week. No thermometer, however, is as good as indicator as the chickens themselves. Their actions will tell at once whether they are comfortable or not.

[Contributed by the Live Stock Division.]

Survey of Soils, Land Use and Soil Erosion in the Coleraine District

By G. Blackburn, B.Agr.Sc., Research Officer, C.S.I.R.O. Division of Soils, and
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Koroite Creek valley, with the township of Coleraine in right background. Note level skyline indicating tableland formation.

Soil erosion, principally in the forms of gullying and stream erosion, has become a serious problem in the hilly portion of the Western District drained by the Wannon and Glenelg rivers. At the invitation of the Soil Conservation Board, the Division of Soils of the Commonwealth Scientific and Industrial Research Organization and the Victorian Department of Agriculture undertook with the Board an investigation of the problem.

The parishes of Konong Wootong and Coleraine, lying respectively north and south of Coleraine township, were selected for a detailed soil survey and investigation of soil erosion. Information was sought also on the causes of landslides which occur throughout the Coleraine-Casterton area.

In this report* the land use and soils are described, an analysis is made of the soil erosion problem and proposals are made for control measures.

AERIAL photographs which had been made by the Department of Lands and Survey, Victoria, of the entire area of approximately 70 square miles, were used for recording in the field the boundaries of different soils, the points at which soil examinations were made, and the occurrence and extent of soil erosion and landslides. The area was traversed at intervals of approximately half a mile. Geological assistance was given by Messrs. F. Beavis and J. L. Knight of the Mines Department of Victoria, in the identification of rock types and in the elucidation of the geological structure and history of the area.

DESCRIPTION OF THE COLERAINE AREA

(*a*) Topography and Geology

Coleraine lies near the southern boundary of the Dundas highlands, a tableland area dissected by the Wannon and Glenelg river systems. In the Coleraine area, relatively little remains of the tableland; its greatest extent in the two parishes is to the east between Coleraine and Wannon. The tableland varies in height from approximately

* A comprehensive bulletin on the soil science (pedology) of the Coleraine area will be prepared and issued by the C.S.I.R.O. at a later date. This bulletin will deal with such matters as the chemical analysis and relative fertility of the various soils.

Massive ironstone on laterite near tableland level, south of Coleraine township. Note gravelly surface and thin vegetative cover often seen on Group 8 soils.

600 feet above sea level in the south and south-east of the area, to approximately 1,000 feet in the north-west. The township of Coleraine lies in the valley of the Koroite (Bryant's) Creek, the largest valley, which has an elevation there of 300 feet above sea level.

The area is generally hilly with some rugged stony outcrops and deep valleys, many of which are marked by gully erosion. Slopes are slight (up to one in 10) on tableland areas, valley bottoms and shallow valleys in the tableland. Moderate to steep slopes (from one in 10 to one in 3–4) occur on the valley sides, with most slopes falling between one in 7 and one in 4. Slopes of up to one in one occur on some very steep landslides and rock outcrops. Evidence of recent and ancient landslides can be seen on many hill slopes.

The Wannon River runs along one of the parish boundaries and is joined by the Koroite Creek, which in turn receives the drainage of the other main waterway, the Konong Wootong Creek, near Coleraine township. Each of these water-courses occupies a wide valley with areas of flood plain. These main water-courses are all permanent streams but most of their tributaries are dry during summer. There are a few creeks connected with permanent springs in the northwest of the parish. These creeks are almost permanent.

There is considerable variety in the rocks of the Coleraine district. Granite is probably the oldest. It is the parent material of some soils in the Konong Wootong parish and is exposed there in some erosion gullies. There are two larger granitic areas and three smaller ones, all but one in the northern parish.

The next oldest is the Permian glacial material which occurs over a wide area, but again only in the northern parish. The deposits include soft sandstones, mudstones and fragmental matter known as till or boulder clay. This till contains a great variety of rocks and pebbles, many of which show irregular shapes due to the polishing received during movement of glaciers. Most of the worst erosion gullies and landslides are in contact with these varied and unstable glacial deposits.

In the Coleraine parish there is virtually no evidence of the glacial material. Mudstones and fine sandstones and thin coal seams of Jurassic age form the bedrock of the country south and east of the Koroite Creek. These sediments are generally approximately horizontal and show some evidence of faulting.

The most recent deposits, apart from flood plain deposits, are the white quartz gravels and sands which cover the tops of several hills in the Coleraine parish.

There are many outcrops of volcanic rock both basalt (blue metal) and trachyte, principally in the Konong Wootong parish. Trachyte, a light-coloured rock, is relatively easily quarried and has been used for building and for purposes where there is no great load or friction. Basalt is darker in colour, more difficult to quarry, and is used principally for road surfaces. The greatest extent of volcanic material, probably originally a lava sheet, is in the north-west of the Konong Wootong parish. Elsewhere there are several conspicuous steep-sided rocky hills, also of volcanic material.

Finally there is the ironstone or lateritic gravel, buckshot and massive ironstone which occurs in all the tableland areas at no great depth. This was not formed under the sea,

nor in a lake, nor is it of volcanic origin. It is actually evidence of a very ancient soil on the tableland areas.

(*b*) Climate

The climate of Coleraine is temperate with a maximum rainfall in winter. There is a well-marked summer dry period which reduces the growing season for pasture plants to not more than nine months in the vicinity of Coleraine and perhaps to ten months in the north-west of Konong Wootong parish. There is a considerable variation in annual rainfall, from an average of 24·4 inches at Coleraine to 31·4 inches at the highest point of the area in the north-west portion of Konong Wootong parish. Average monthly and annual rainfall for the two recording stations are given in Table 1.

Temperature recordings are not available for Coleraine but those made at Hamilton, approximately 20 miles to the east, may be regarded as indicative of the climate at Coleraine. In the winter months, the average air temperature at Hamilton closely approaches 45°F., the figure at which it is considered pasture growth becomes dormant. Frosts may be expected between early April and mid-November. On the average approximately 12 heavy frosts occur each year.

In the summer, rainfall is low and temperatures and evaporation are high, virtually prohibiting plant growth.

TABLE 1—AVERAGE RAINFALL IN THE COLERAINE DISTRICT.

Recording Station.	Coleraine Post Office.	Mr. M. Straede, Konong Wootong.
Period.	46 years.	21 years.
	points	points
January	104	160
February	121	159
March	165	206
April	182	289
May	236	269
June	256	306
July	267	358
August	274	353
September ..	275	321
October	235	296
November.. ..	171	212
December ..	153	214
Year	24·38 inches	31·41 inches

Valley formation near Coleraine showing (a) zone of red gums and other eucalypts in and about tableland level (Koroite soil) and (b) treeless, uneven valley slope showing evidence of ancient landslides. The dark dots are patches of rushes which extend uphill to the site of seepage. Note erosion gully in foreground. Bellwyn soil occurs on valley slopes here.

Aerial photograph, scale 23½ chains to 1 inch, of about 2,000 acres, east of Coleraine. The picture shows "A," the Koroite (Bryant's) Creek, with flood deposits of coarse sand, elevation about 300 feet; "B" is a tableland area, elevation about 700 feet, with typical growth of red gums and soil of the Koroite Series. The gridiron pattern of topdressing indicates the limits of the tableland. The depression is a small dam. "C" is a tableland remnant with dead manna-gum trees and soil of the Gritjurk Series. "D" is a soil boundary between Group 8 and Group 5 soils. "E" indicates landslides, with areas of bare soil (white) and wet sections (black). "F" is an erosion gully, with Bellwyn soil to the east. "G" shows tunnel erosion on small areas of Bryant soil. At "H," siltation of a farm dam is shown resulting from gully erosion and landslides upstream. At "I," Swan soil is cultivated for potatoes. "J" is the Coleraine-Melville Forest Road and "K" indicates farm buildings with tree plantations.

(c) Vegetation

The native vegetation is of two types :—

(1) Open grassland.

(2) Timbered grassland (savannah woodland or parkland).

The first originally consisted mainly of the native grasses—spear grass (*Stipa* spp.), wallaby grass (*Danthonia* spp.) and kangaroo grass (*Themeda australis*). White tussock (*Poa* spp.) occurred on wetter sites. Other plants of this vegetation type were rushes (*Juncus* spp.) and occasional composites of the daisy family.

Since settlement there have been many changes in the composition of the open grassland. Clovers and medics have spread more or less rapidly. Thistles have gained a footing, particularly where the soils have been disturbed by cultivation or by rabbits. Capeweed grows thickly on light textured soils where soil fertility is higher, as, for instance, about sheep camps. Barley grass (*Hordeum maritimum*) is established on many areas of heavy soil subject to waterlogging in winter. Perennial rye grass is present as a result of its sowing with subterranean clover for stands of permanent pasture, and it has spread naturally throughout the more fertile grassland.

The timbered grassland is associated conspicuously with the tableland, but occurred also elsewhere over a limited area. The principal members of this vegetation were :—

Trees—

Red Gum (*Eucalyptus camaldulensis*) Manna Gum or White Gum (*E. viminalis*), Swamp Gum (*E. ovata*), Sheoak (*Casuarina stricta*), Prickly Acacia (*Acacia armata*), Black Wattle (*A. mollissima*), Blackwood (*A. melanoxylon*), Box or Christmas Bush (*Bursaria spinosa*) and Honeysuckle (*Banksia marginata*).

Grasses and Rushes—

Wallaby grass (*Danthonia* spp.), Kangaroo grass (*Themeda australis*), Spear grass (*Stipa* spp.), Rushes (*Juncus* spp.), White Tussock (*Poa caespitosa*).

Red gum is the dominant tree on tableland areas of parkland. Sheoak is limited mainly to soils with shallow gravel or rock and is the only tree over certain areas of timbered grassland. Honeysuckle is almost extinct in the district now, but early records show that it occurred on all parts of the tableland.

There has been much thinning out of the parkland trees, both for firewood and for fence posts. After the first world war a number of timber mills operated on red gum felled from the Dundas tableland. One mill was situated at the Parkwood (*Gritjurk*) Railway Station.

The composition of the grassland in the timbered areas does not appear to have changed as much as in open grassland areas. Medics have spread and subterranean clover achieves local dominance after heavy top dressing on some portions of the timbered grassland.

SETTLEMENT AND LAND USE

The principal stages in the development of the area were :—

1. The Pioneering Stage 1838–1862

With the successful establishment of the pastoral industry by members of the Henty family in the Portland and Casterton districts other squatters took up land for wool production near Coleraine during this period. The two parishes were divided among a few pastoral stations. Land tenure was not subject to well-defined conditions, and communications were primitive. There was little cultivation. Landslides were noticed by early settlers and the use of drainage lines as traffic routes aided the development of erosion gullies later.

2. Consolidation of the Wool Industry, 1862–1910

The parishes were surveyed and land tenure put on a firm legal basis in 1862 The township of Coleraine was established, and roads, bridges, a railway and other regular means of communication made their appearance. Rabbits became firmly established in the area. Cultivation extended mainly to supply the needs of the increased horse population and to fulfil the requirements of land settlement laws. During this period many of the erosion gullies commenced, some being well marked as early as 1870. The introduction of rabbits, interference with natural drainage by roadmaking, and cultivation of hilly country were three factors which influenced gullying.

Collapse of the side of an erosion gully. Shattering of the surface is a feature of soil movement at Coleraine.

3. Closer Settlement 1910–1925

During this period pastoral holdings amounting to approximately two-thirds of the area were acquired by the State Government, for closer settlement in 1910, and for soldier settlement after the first World War. These Crown lands were divided into small holdings of from 150 to 250 acres designed for dairying.

4. Closer Settlement Consolidated, 1925–1949

This has been a period of technical improvement in the closer settled areas and of changes affecting the pastoral holdings as well. The principal changes have been as follows :—

(1) The substitution of the motor vehicle for the horse, altering the demand for oaten hay and leading to a reduction of the amount of cultivated land, and thus encouraging greater attention to pasture development.

(2) The use of superphosphate and subterranean clover for the improvement of pastures. This practice has doubled the carrying capacity on tableland soils and is leading to a change in the breeds of sheep grazed and also in the size of holdings on the poorer lands.

(3) The change-over from cultivation of land and production of oaten hay for dairy stock to the establishment of permanent pastures of perennial rye grass and subterranean clover.

(4) Increased mechanization of agricultural production, especially on dairy farms, particularly shown in the introduction of milking machines, hay balers, and mechanical fertilizer spreading.

At the present time the well-established pattern of dairy farms is undergoing some deterioration. Since the Second World War, some land-holders have given up dairying and taken up fat lamb production.

SOILS OF THE COLERAINE AREA

There are three broad classes of soils in the Coleraine area. These are :—

1. *Podzolised soils* with grey light-textured, (often sand) surface and sub-surface overlying clay subsoil. These soils are moderately to slightly acid and do not show lime in the subsoil. Included in this group are the tableland soils which are notable for their content of ironstone either as gravel or as massive material.

2. *Black earths* of heavy texture, slightly acid at the surface, but with some lime at a depth of 2 to 3 feet. This class includes all the best hill soils used for dairying in the Coleraine parish, the black soils of the valley bottoms, including those of the Wannon river flats, and most of the heavy soils of the Konong Wootong parish except those in the volcanic area to the north-west, or associated with stony volcanic outcrops.

3. *Volcanic Soils.*—These are black, dark brown or chocolate soils of variable depth. They include the most acidic of all soils in the area. They occur mainly in the north-west of Konong Wootong parish, but are also scattered over the remainder of that parish. There are also three major outcrops of such soils in the Coleraine parish.

Besides these three main classes there are several groups of mixed soils which are developing on material moved by ancient or recent landslides. Deposition of flood-borne sand is also of consequence along the Koroite Creek.

Soils which have the same appearance and textural gradation in the vertical section (profile) are regarded as of the same type.

Local names have been given during this survey to 15 series of soils. Within each soil series there are of course variations, but these variations do not appear to be of such significance in general land use and soil conservation as to warrant more detailed mapping at present. The chief characteristics of the soil series defined in the district are given in a later section of this report.

SOIL CONSERVATION

Erosion gullies, stream-bank erosion, flooding and accumulation of coarse flood debris on pastoral land are the problems which cause the demand for soil conservation. There are also many landslides in the district and the areas affected in this way tend to become scarred by erosion gullying. This has happened in the case of the two most serious landslides near Coleraine, which affect a railway line and a road.

Sheet erosion is not a feature of the district though it may have occurred extensively at some early stage of settlement. At the present time very little cultivation is undertaken and pasture growth protects most of the steep hillsides, except possibly in summer periods when there is a scarcity of grazing for stock.

Erosion gullies appear to be the worst form of soil erosion at present. Many acres of valuable grazing land have been washed away as a result of this erosion, which results in deep steep-sided gullies. These ravines cannot be crossed by any farm implements and serve as a harbor for rabbits. They are often a hindrance to the movement of stock, whose concentration on a few crossing places may encourage further tributary gullies.

The main growth of the gullies takes place lengthwise along the line of main drainage, but in some cases they are broadened by slumping of the sides. Headward erosion of a gully may carry it into the site of a landslide, in which case immense damage may be done within relatively few years; for the landslide area cannot then reach stability but will keep on slipping.

The outstanding problem of soil conservation in the Coleraine district is the control by means of vegetation of water movement down steep-sided valleys. In normal years, with high rainfall of relatively low intensity, gully erosion does not proceed rapidly, but occasionally, as in 1946, falls are heavy and intense over a period. Then erosion gullies extend rapidly, landslides are fostered,

Left—Typical gullying in sandy, glacial, "till" associated with Bryant soils. Note light colour of exposed sandy material, V-shaped gully and seepage through gully walls.

Below—Erosion gully north-east of Coleraine. The gully occurs in deeply weathered kaolinitic granite.

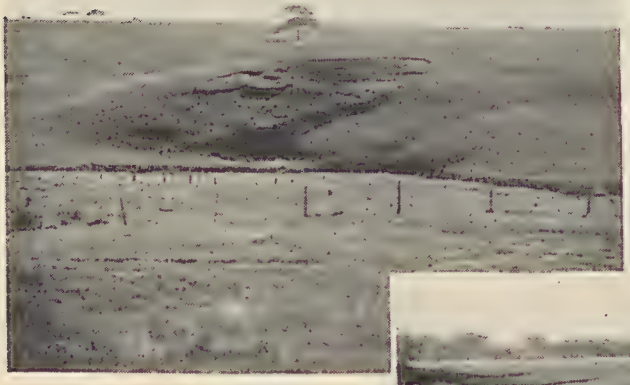
flooding and stream-bank erosion occur and, after flood waters subside, a trail of debris is left on valuable creek flats.

Pasture management and pasture improvement are the best methods for control of run-off on sloping ground. There can be no effective work in this direction, however, without eradication of rabbits, of which there are many on some properties. Erosion gullies and sandy podzolised soils provide harbor for these pests.

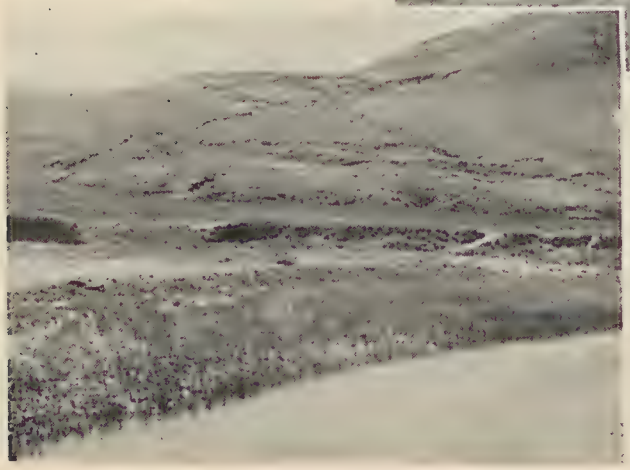
Together with measures to control run-off from valley slopes, special efforts involving fencing, earth-moving and planting of vegetation are necessary to combat headward erosion of gullies. Attention to road drainage is necessary in some places where the establishment of culverts has been followed by erosion down-slope.

Soil conservation needs to be undertaken on the basis of catchment areas. Thus, control of the various types of erosion found near the Koroite Creek depends on the adoption of measures taken throughout the catchment area of this creek. Even where erosion is insignificant, effective measures should still be used to slacken run-off rates and thus reduce the flood hazard during periods of heavy rainfall.

A further contribution to conservation might be made by the erection of a structure to control flood waters in the Koroite Creek. Impounded waters might be used for summer irrigation of the considerable areas of Wannon soils, if investigations prove their suitability for this purpose. If such areas could be



Upper picture—Landslide south of Coleraine. Koroite soil occurs on skyline with Group 8 soils in the vicinity of landslide. Shadows show scars and accumulation of slipped soil.



Centre picture—Large landslide in head of the valley just below tableland area. Typical red-gum parkland may be seen on skyline.

Left—Landslide near Konong Wootong Creek, Coleraine. Note typical bulbous area from which slide moved through narrow throat to spread over lower land.

irrigated with profit, then the production of summer fodders, by reducing the fodder scarcity in summer, would aid in soil conservation.

THE VARIETY AND CHARACTERISTICS OF COLERAINE SOILS

Seven principal groups of soils may be distinguished fairly readily in the Coleraine area. These are :—

I. Soils of the flat-topped tableland areas. These are associated with a rich native growth of trees, particularly red gums.

II. Light-textured and light-coloured soils occurring below tableland level. The soils do not contain ironstone gravel and are often revealed by the burrows of rabbits. The native vegetation included sheoak trees.

III. Medium and heavy-textured dark-coloured soils of the hills, valley sides and flats. The area of these soils is extensive in both parishes. The native vegetation apparently did not include trees. These soils support the best pasture.

IV. Chocolate and brown soils. The former supported a native growth of eucalypt trees, whose dead trunks and charcoal can still be seen in the area. The brown soils are generally associated with relatively shallow rock.

V. Highly variable soils on landslide material.

VI. Highly variable soils found in association with volcanic rocks.

VII. Shallow rocky soils.

The distribution of the soils in the Coleraine area is illustrated by the soil map on pages 456 and 457.

I. Soils of the Flat-topped Tableland Areas

Soils on Higher Portions of Tableland

Gritjurk series.—Light-textured surface free from ironstone gravel in top 6-12 inches, underlain by heavy ironstone gravel and mottled yellow and red clay.

Soils on Lower Tableland Areas and Edge of Tableland

(i) Soils containing ironstone gravel.

Brit Brit series.—This soil is comparable with the Gritjurk soil but the clay horizons are much closer to the surface, the surface soil is notable for its content of sharp coarse sand and its ability to set with a cement-like consistency. It occurs only on small areas.

Balochile series.—This soil also is comparable with the Gritjurk soil but like the Brit Brit soil there is no great depth to the gravel and clay. Sharp coarse sand is not conspicuous. The only occurrence is on small flat-topped areas surrounded by volcanic soils in the north-west portion of the Konong Wootong parish.

Koroite series.—This is the most common soil of the tableland areas. It is very like the Balochile series, though with more yellow colour in the subsoil, and apparently of more fertility. It is the most common tableland soil under red gum and wallaby grass.

Group 8 soils.—These soils are variable and include all those occurring along the sloping edge of the tableland and containing ironstone gravel in quantity. In many places the soils have a light textured surface and are comparable with the Gritjurk soil, but in other places the texture is heavy and the soil is dominated by ironstone, either as gravel or massive rock.

(ii) Soils containing no ironstone gravel.

Parkwood series.—This soil is a dark, heavy-textured, poorly drained soil occurring on depressions or "swamps" on the tableland. Such areas are often indicated by the lack of trees, the poverty of the grass vegetation and a relative moistness of the soil. The profile contains no ironstone, but usually has visible lime at about 24 inches. Uneven, "crabholey" areas are often present.

II. Light Textured and Light Coloured Soils Occurring Below Tableland Level

Surface Soils with Conspicuous Content of Sharp Coarse Sand

Hassall series.—These soils have a clay subsoil under a fairly deep lighter textured top soil. Red gums and some sheoaks occur naturally on this hillside soil. Weathered granite may occur at depth in the soil.

Konong Wootong series.—There is no clay subsoil, and the soil appears fairly uniform for some depth until weathered granite, notable for its content of golden-coloured mica, is reached. These soils are apparently too-well drained to support red gum trees, but sheoak trees occur naturally. Slopes are often steep and long.

Surface Soils with No Conspicuous Content of Sharp Coarse Sand

Hilgay series.—Soils situated on hilltops in Coleraine parish and distinguished by prevalence of rounded white quartz gravel and rubble either in the soil or in the vicinity (as shown by rubble pits). Many soils have clay subsoil and supported sheoak trees in the natural state. Slopes are often steep.

Bryant series.—This soil occurs on hillsides and small hills in Konong Wootong parish. The surface is light in colour and texture but has a darker clay subsoil at about 24 inches. Tunnel erosion ("water tunnels") is almost restricted to this class of soil. The only natural tree vegetation appears to have been sheoaks.

Series X.—There is a very small area of this soil in he north-east portion of the Konong Wootong parish. The clay subsoil is distinguished by reddish colours.

Series Y.—This soil occurs only along major creeks and particularly upstream and downstream from the junction of the Konong Wootong and Koroite creeks, usually on elevated creek terraces. A light-coloured compact sandy- extured topsoil overlies a clay subsoil.

III. Medium and Heavy Textured Dark Coloured Soils of Hills, Valleysides and Flats

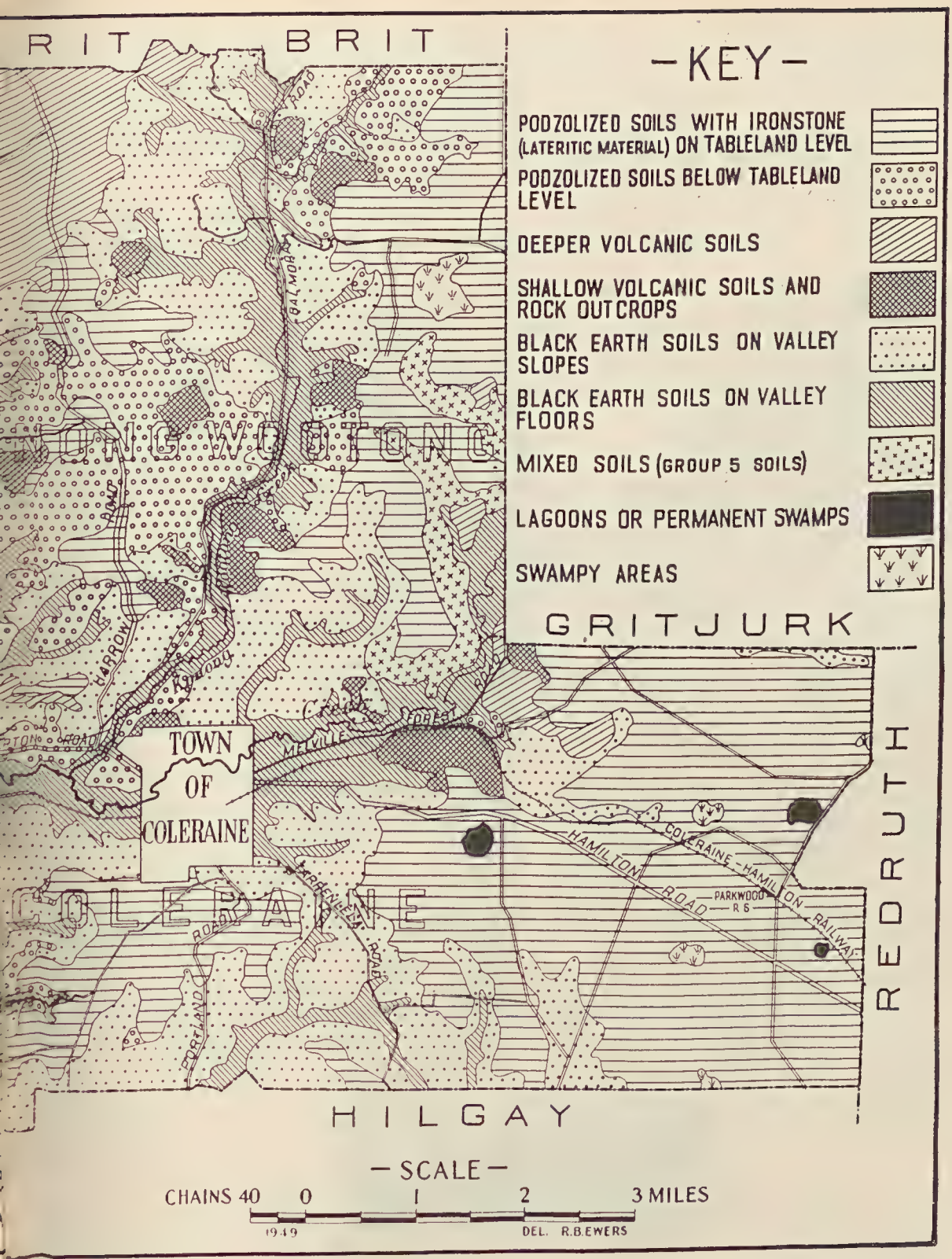
Soils of the Creeks and River Flats

Whyte series.—This is a heavy-textured crumbly soil overlying compact yellowish silty material at two or three feet. Lime is usually present near the change in colour of the soil material. This soil occurs only along minor creeks and lower valley slopes.

Wannon series.—This is similar in many respects to the Whyte soil, but is poorly drained, has a poorer structure and occurs on the flood plains of the Koroite creek and Wannon river. A growth of rushes often predominates.

Soils of the Upper Valley Slopes

Swan series.—Black or very dark brown soils occurring on volcanic rocks, often basalt ("bluestone"). Weathered rock, generally yellowish in colour, underlies the soils and pieces of rock often lie in the soil and on the surface. The areas are sometimes of an uneven surface with small hillocks and rock outcrops.



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PODZOLIZED SOILS WITH IRONSTONE (LATERITIC MATERIAL) ON TABLELAND LEVEL
PODZOLIZED SOILS BELOW TABLELAND LEVEL
DEEPER VOLCANIC SOILS
SHALLOW VOLCANIC SOILS AND ROCK OUTCROPS
BLACK EARTH SOILS ON VALLEY SLOPES
BLACK EARTH SOILS ON VALLEY FLOORS
MIXED SOILS (GROUP 5 SOILS)
LAGOONS OR PERMANENT SWAMPS
SWAMPY AREAS
GRITJURK
TOWN OF COLERAINE
COLERAINE
HAMILTON ROAD
COLERAINE-HAMILTON RAILWAY
PARKWOOD R 6
REDRUTH
HILGAY
-SCALE-
CHAINS 40 0 1 2 3 MILES
1949
DEL. R.B.EWERS

Coleraine series.—Stone-free soils occurring only in the Coleraine parish. Generally the soil is mellow and rich in organic matter. Weathered yellowish or greyish rock occurs at from two to three feet from the surface.

Bellwyn series.—These soils occur north and west of Koroite Creek and are mellow, well-structured, and generally rich in organic matter. Many of the soils have surface stone. They are the counterpart, in the Konong Wootong parish, of the Coleraine soils.

Group I.—These are stone-free soils with bright-coloured mottled subsoils (red, green, purple and cream), which occur only in the north-west of Konong Wootong parish, in a mixture with chocolate soils containing rusty-coloured rubble.

IV. Chocolate and Brown Soils

Beerik series.—Deep volcanic soils of chocolate surface and red clay subsoil. The soils are stoneless and carried timber in their natural condition. They occur in the north-west of the area.

Group 3.—These soils occur in the north-east of the Konong Wootong parish near Hassall's creek. The soil is a dark-brown loam overlying volcanic rock at varying depths. Rock outcrops occur sporadically.

V. Highly Variable Soils on Landslide Material

These soils are characterized by a very uneven surface, with evidence of recent landslide and older soil movement. Such soils occur mainly in the northern parish, particularly along the west side of the Koroite Creek and tributaries entering the west side of that creek There are minor areas of soils adjacent to the massive outcrops of volcanic rock occurring along the Konong Wootong Creek.

In the Coleraine parish the occurrences of soil complexes are limited to the sites of very large ancient landslides on the north bank of the Wannon River. The more mature soils in this complex (Group 4), are comparable with the Coleraine soils but are darker and moister, due to greater shelter from the sun.

VI. Highly Variable Soils Found in Association with Volcanic Rocks

In this case variability is not indicated by surface relief, but in colour both of the surface and subsoil. There are two localities at which such variable soils have been mapped as complexes, termed Group 1 and Group 2. Group 1 lies in the north-west of the northern parish. It contains very small areas of Beerik soils, more extensive areas of Group 8 soils and other unnamed variable soils, brown, chocolate, grey or black on the surface, and with either red, yellow, purple or green colours, alone or mottled, in the subsoils. Rusty concretionary material of a rather soft nature and hard buckshot gravel are found in some of the soils. Outcrops of rock do not occur, nor is rock found under the soil.

In Group 2 complex, near the railway line in Coleraine parish, the soils are variable as to depth to rock and show variation in surface colour, from black to chocolate. The chocolate soil in this case is not a replica of the Beerik soil although there is a common surface colour.

VII. Shallow Rocky Soil

Soils have been described as skeletal when the soil is shallow to rock and without any differences, as of colour or texture, between the top and bottom of the soil.

Skeletal soils occur only on volcanic rocsk in this area, the two important rocks being basalt and trachyte. These as closely allied rocks are not always readily distinguished from one another. In general all the dark rocks may be regarded as close to basalt and the lighter-coloured ones as trachyte.

The second and concluding instalment of this article will appear in a subsequent issue of the Journal.

Cultivation in Victorian Orchards and Vineyards

Advantages and Disadvantages

By A. G. Goudie, B.Agr.Sc., Horticultural Research Officer

UNTIL quite recently, growers who kept their orchards and vineyards free of weeds in the spring and summer by frequent cultivation were regarded as highly efficient. There is now a widespread trend by progressive growers, however, both in Australia and overseas, to restrict cultivation. This has occurred, not because growers are becoming untidy or dilatory, but because it is becoming increasingly evident that frequent cultivation can result in a serious decline in soil fertility, depite soil improvement measures such as the growing of good winter cover crops. The basic advantages and disadvantages of cultivation need to be considered so that a grower can decide to what degree his particular orchard should be cultivated.

Cultivation experiment on a Red Cliffs citrus grove. Left—Clean cultivation. Right—Lucerne.

The main advantages of orchard cultivation are :—

It prepares the ground for irrigation and drainage.

In certain circumstances it improves the capacity of the soil to take in water.

It controls the growth of weeds.

The main disadvantages are :—

It is costly.

It keeps the roots out of the upper layers of soil which are usually the most fertile.

It reduces soil fertility.

ADVANTAGES OF CULTIVATION

Obviously, it is necessary to cultivate the soil when an orchard is established to smooth out surface irregularities and, in irrigation districts, to prepare lines of drainage and a surface suitable for irrigation. It might be desirable in certain districts to re-form irrigation or drainage surfaces, say, annually, but this should not be regarded as absolutely necessary. There are thousands of acres of completely uncultivated yet healthy orchards, both in wet climates, where effective surface drainage is necessary, and in irrigated areas. It is clear, therefore, that practically permanent irrigation and drainage surfaces can be established in orchards.

Soil Moisture Supply

A cultivated surface does reduce rainfall run-off by trapping the water amongst the clods until it soaks into the sub-soil.

Winter-growing annual trefoil in a Woorinen vineyard.

However, a more effective method is to plant trees on the contour, and terrace between the rows. This is practised by some Victorian growers; but those whose orchards are already planted on a square pattern will usually have to rely on cultivating across the slope to reduce run-off of rain falling during the growing season.

Irrigation water can usually be made to penetrate to greater depths by cultivating just before watering. However, the Goulburn Valley is the only irrigated horticultural district where there is any widespread difficulty in wetting the lower part of the root zone; in fact, the usual problem in other districts is how to prevent over-irrigation.

The permeability of really tight Goulburn Valley soils is usually not improved by cultivating before irrigation. On the other hand, moderately impermeable types, especially those with a sandy-loam surface, are known, at least in some cases, to soak up water much more freely from freshly-prepared furrows. The soil usually seals up to its previous condition after one irrigation. Unfortunately, each cultivation compacts the soil a little more and tends further to reduce its capacity to soak up water so that a temporary improvement is gained at the cost of permanent damage. Thus, if these soils are cultivated before each irrigation to improve penetration, the process is analagous to living on capital.

It is probably worthwhile to discuss the obsolete idea that cultivation conserves soil moisture because it breaks the capillary tubes that bring moisture up from the sub-soil. There is no such upward movement of water, except perhaps in winter and early spring, unless there is a water table within a few feet of the surface. Penman, of Rothamsted Experiment Station, has studied the evaporation of soil moisture under carefully-controlled conditions, using both sandy and clay-loam soil, and has shown that the conservation affected by cultivation mulching is not appreciable, even under conditions characteristic of winter and early spring. Horticulturists with a shallow water table would hardly be concerned with conserving soil moisture and these conditions will not, therefore, be discussed.

Perhaps the studies most directly applicable to our conditions are those of Veihmeyer, in California. This worker used tanks each containing about half a ton of soil which were weighed at frequent intervals by means of a portable derrick and suspension scales. Some tanks were allowed to grow weeds; others were cultivated at various depths up to 10 inches as often as once a week; others were never cultivated, but weeds were pulled out as soon as they germinated. Two of Veihmeyer's conclusions were:—"Cultivation did not influence the losses of moisture by evaporation from the bare surfaces of the soils in the tanks and in the field plots under observation in these experiments," and "About half the loss of moisture by evaporation in 80 days occurred in the first week after irrigation and the greater amount of this was lost before the soil was in a condition to be properly cultivated."

If we accept the evidence that there is no capillary movement of moisture up from the sub-soil then it is easy to visualize how the dry crust of soil formed during the first few days after rain or irrigation will itself enormously reduce evaporation from the lower moist horizons. The moist soil is shaded, insulated from the direct heat of the sun, and the passage of water vapour upwards to the air is impeded by the dry crust.

Some idea of this reduction in evaporation can be obtained from the work of Russel, of Nebraska Agricultural Station, who determined that a 1½-in. covering of air-dry soil reduced evaporation from field-moist soil by an average of 91 per cent. under summer conditions. By comparison, a straw mulch of 4 tons per acre produced

a 73 per cent. reduction and straight out shading of the soil produced a 36 per cent. reduction. These results only apply so exactly to the particular conditions under which the experiment was carried out.

The above examples should show why cultivation, in itself, is no longer considered to conserve moisture by "breaking the capillary tubes".

Control of Weeds

The main justification for cultivating orchards is to control weeds. It is easier to control pests and diseases in clean orchards; it is easier to harvest the crops; in fact, fruit pickers often seek penalty rates while picking in orchards where weeds are moist from dew or rain and they object to picking grapes where weeds are growing up around the bunches. More important, however, weeds or permanent cover crops compete very strongly for available soil nitrogen and soil moisture during the growing season of the tree or vine.

Permanent covers, even of lucerne or clover, can cause nitrogen starvation for some years until a sufficient supply of nitrogen-rich organic matter is built up in the soil. Mature peach trees at Tatura Research Station showed nitrogen deficiency symptoms during their first season under lucerne or white clover, even though 11 cwt. per acre of sulphate of ammonia was applied in four dressings during the spring and summer. Clean cultivated plots receiving 4 cwt. per acre in two dressings showed no such symptoms. Therefore, if an orchardist attempts any form of management involving the growth of summer cover crops he must be prepared to increase his application of nitrogenous fertiliser.

Perhaps the most important benefit of clean cultivation is to prevent competition by weeds for soil moisture. Weeds usually take at least 25 gallons of soil moisture, and may take up to 120 gallons in order to produce 1 lb. of dry matter. The amount varies with species, stage of growth, climate, and available soil moisture. A vigorous summer cover crop of weeds or lucerne could easily contain 1½ tons per acre of dry matter and would, therefore, use something like 4 inches of water during growth. Growers are well aware that cultivation saves soil moisture but they usually attribute the saving to the "breaking of capillary tubes", quite overlooking the tremendous effect of weeds on soil moisture.

Aeration

Another obsolete idea is that cultivation is necessary to provide sufficient aeration for horticultural crops. One has only to observe the health and productivity of orchards which are never cultivated to realise that air can readily diffuse through uncultivated soil.

There are many citrus groves in California which have been kept free of weeds by means of oil spray since 1940 and never cultivated since then. Growers report better tree condition and increased yield. Actually, air can readily pass through pores which are too small for water to pass through; and, if the pores in a soil surface are too small for water to pass through, then such soil is, in any case, undesirable for horticultural use. An interesting thought is that probably the quickest method of making the soil atmosphere low in oxygen is to apply organic matter to the soil and then irrigate. Soil organisms rapidly convert oxygen to

A plum orchard near Horsham with a permanent cover crop of clover.

carbon dioxide during the process of decomposing organic matter. Reuther and Crawford in Florida have shown that soil oxygen at 10 inches depth in heavily-manured plots can drop from 12 per cent. to less than 1 per cent. within six hours after irrigation and not recover the pre-irrigation level for eight days. Control plots without organic manure, and, therefore, with less respiration by soil organisms dropped only from 18·5 per cent. to 12 per cent. oxygen in the soil atmosphere after irrigation.

Because there is no popular concern about the quality of the soil atmosphere in the extreme case of freshly ploughed-in organic matter, and because there is no evidence of insufficient quantity of soil atmosphere among completely uncultivated orchards, there is really no reason why aeration should be used as an excuse for cultivation. Aeration is very poor in waterlogged soils but cultivation is, of course, no remedy in such cases.

DISADVANTAGES OF CULTIVATION

The main disadvantages of cultivation are that it is costly, keeps roots out of the upper most fertile layer of soil, and that it results in a reduction of soil fertility. The first two points need no further discussion, except perhaps to say that, in these days of mechanized orcharding, every cultivation represents a cash expenditure on fuel and oil.

The main adverse effects on soil fertility are that soil organic content is reduced and soil structure is damaged. The highly successful growth of plants in water and in pure sand culture indicates that organic matter possesses no mysterious properties necessary for plant growth. However, it is very desirable in soil because it is a valuable source of available plant nutrients. Also, organic matter increases the capacity of a soil to store moisture, and assists in the maintenance of a stable soil structure.

Cultivation reduces organic content by preventing the growth of plants whose organic constituents would otherwise be returned to the soil after death. Also, soil temperatures become higher because of the lack of shade under clean cultivation. The higher the soil temperature the more rapidly does organic matter decompose.

A good soil structure is one in which the particles of clay and silt are bound together to form larger "crumbs", themselves separate from each other, and which do not disintegrate when wetted. The pore spaces between these crumbs permit water to enter the soil freely, and rootlets are able to explore the whole soil mass. Structure suffers when cultivation begins. When the soil is moist, implements can pack these crumbs tightly together and greatly reduce pore space. Most growers can recognise the "plough sole" which results. The shiny side of a freshly-turned sod is a face of smashed crumbs, the clay and silt components of which have filled in all the pores. Each cultivation fills in more of these vital pores. Organic materials are usually the main cementing material in the crumbs, and, as the soil organic content falls, crumbs become less stable.

The effect of cultivation on soil structure is severe in some soils and hardly noticeable in others. Most orchard soils of the Goulburn Valley and Cobram area become very compact and cloddy, and tend to run together when water is applied, if cultivation

Citrus growing without cultivation at Long Lake.

has been practised frequently. Interesting examples exist in sections of the new Cobram Soldier Settlement area wherever virgin soil occurs adjacent to wheat paddocks. Water will commonly penetrate to a depth of at least 2 feet in an hour on the virgin soil as compared with less than a foot in the old wheat paddock.

Contour planting conserves summer rain. This citrus grove is located in the Warby ranges near Wangaratta.

It is quite likely that many of these old wheat soils will become fairly impermeable to water after very few years under fruit trees, because much of their original structure has already been destroyed by cultivation. Every effort should be made to slow down soil deterioration by growing winter cover crops and narrow strips of summer cover crop between the rows. It is wise to clean cultivate young orchards in clay-pan soils such as these, during the summer, because weeds dry out the clay sub-soil between irrigations and make it difficult for the root system of the young trees to expand.

The heavy alluvial horticultural soils of Murrabit and Swan Hill seem to keep their crumbly structure even under long-continued clean-cultivation practice. Soil structure is not a particularly important consideration on sandy soils, either, because they are usually permeable and free-working in any case. Therefore, in general, Victorian dried fruit and citrus growers have no great problems associated with soil structure and they can disregard loss of structure during a consideration of cultivation.

Alternatives to Cultivation

Unfortunately, every alternative has its disadvantages. Chemical weed control is costly for the first two or three years until the weed and weed-seed population is reduced. At least 150 gallons per acre of oil will be needed in the first year; some Californian growers use up to 500. Crude oil killed all varieties of weeds in trials at Mildura and lowered the weed population more quickly than did power kerosene.

Permanent legume cover crops may be either annual or perennial. Of the perennials, lucerne grows vigorously in all the northern horticultural areas. Grown among mature citrus trees under spray irrigation on Mr. J. H. Ramsay's grove at Redcliffs, it was associated with a high percentage of undersized fruit, even though four extra irrigations were arranged. This indicates how difficult it is under a roster system to ensure sufficient water supply for both trees and lucerne.

On the other hand, very unthrifty citrus on Mr. B. Delves' grove at Long Lake have made a remarkable recovery after several years under lucerne sod and produce fruit of acceptable size. This grove was furrow-irrigated and had a very high water table. Vines on Mr. H. M. Cottman's property at Woorinen have suffered no apparent ill-effect due to competition from a permanent lucerne stand. This district has a 21-day irrigation roster.

Peach trees at Tatura showed no ill-effect from permanent white clover sod after the second year; trees under a three-year-old lucerne sod are showing gummosis which may or may not be associated with the lucerne. Trees under permanent perennial sod require approximately 50 per cent. more irrigations during the summer than do clean-cultivated trees.

Annual legume cover-crops such as barrel clover, subterranean clover, and burr medick tend to become infested with such unpleasant summer-growing weeds as "love grass", "hard-head thistle," "dock,"

and " wild lettuce ". Theoretically, winter-growing annuals should leave the trees or vines free from competition during summer, while the dead mat of cover crop should shade the soil and reduce evaporation losses. In our experience, summer weeds in the Murray Valley soon become so dense that they have to be cut regularly and are a significant drain on soil moisture.

Many Goulburn Valley growers allow summer weeds to grow unchecked from late November to March. They are fortunate in that wild millet is specially suited to the environment and grows so vigorously that unpleasant weeds are choked out. Trees are often seen suffering from mild nitrogen deficiency, and water is required more frequently; however, soil organic matter is built up and the soil structure is saved from the adverse effects of summer cultivation.

Straw mulch practically eliminates the need for cultivation, supplies organic matter and conserves soil moisture, but it is expensive and creates a fire hazard.

Summary

Broadly speaking, growers should restrict cultivation to the minimum possible requirements. Specific benefits can be expected from sod culture under some special conditions—for example, it has been observed that citrus suffering from the effects of waterlogging respond to permanent lucerne and that permanent cover crops will eventually improve water penetration into very impermeable soils. In unirrigated orchards, or in orchards with a restricted water supply, it would be most unwise to allow any considerable growth of weeds in summer.

The majority of growers in northern Victoria are fairly well supplied with water, their soils are at least moderately permeable and they have no immediate water-table problem, so the above specific benefits might not apply. Nevertheless, beneficial effects on soil fertility have been evident in the Swan Hill and Goulburn Valley districts where cultivation has been eliminated. The effects of no cultivation on trees and vines have not yet been measured accurately, therefore no specific recommendation for its adoption can yet be given.

For the present, growers are advised to reduce cultivation to a minimum, having regard to water and nitrogen supply, and to the other factors which have been discussed in this article.

FARM WATER SUPPLY

Normal milk contains about 87 per cent. of water so that, unless a cow has access to a plentiful supply of clean, fresh and palatable water, her milk flow must suffer.

The water requirements of the various classes of stock vary widely depending on the temperature and humidity of the air, the dampness of the food, succulence of the pastures, and the amount of milk secreted. High-producing cows may consume up to 50 gallons of water per day, but the average would be from 10 to 15 gallons per day.

In planning water supplies, it is wise to work on the assumption that rain may not fall for several months in the year. The water should be fresh, palatable, and as cool as can be made with adequate shade. Clear running water in a shaded creek is ideal. Where dams are in use, they should be fenced in and a windmill used to pump water to the various paddocks. If cattle have unrestricted access to a dam, there is a danger of contamination and the water may become a means of transmitting animal parasites. Further, as the water recedes, the boggy conditions contaminate udders with mud, entailing extra work in the cowshed.

[Contributed by the Dairying Division.]

By H. J. Sims, M.Agr.Sc., B.Com., Cerealist

RYE, a cereal native of Europe and Asia, is widely cultivated in those continents, especially in the northern parts. It is valued there chiefly for its grain, from which black bread is made, and for its straw, which is used for thatching, paper making, and bedding of animals.

In the British Isles rye is grown mainly for green fodder. In various countries of northern Europe, it is grown under conditions too cold for wheat, and also on land too sandy, saline or acid for other cereals. Black bread is the staple cereal food in many northern European countries, but is generally regarded as inferior to wheaten bread.

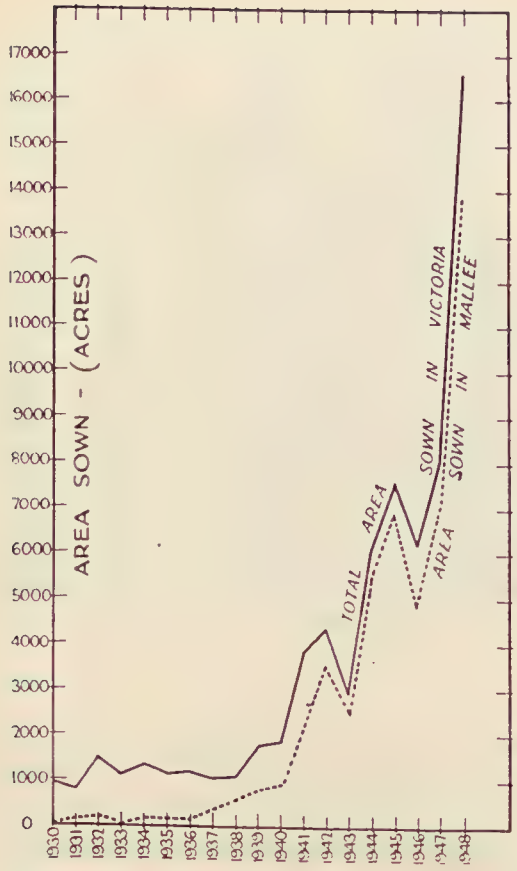
In 1938 the area of rye sown in the world was approximately 98 million acres. In the same year wheat occupied 430 million acres. The average annual pre-war production of rye was 1,730 million bushels, while that of wheat was 6,010 million bushels. The estimated world production of rye in 1948 was 1,605 million bushels, of which 1,517 million bushels were grown in northern Europe, and 53 million bushels in North America. From these figures it will be seen that the Australian production of less than a quarter-million bushels is of small importance in the world production of this cereal.

In 1945–46 the Australian acreage was nearly 63,000. South Australia, with 52,000 acres, had the largest area. The acreages sown in the other States were approximately as follows :—Victoria, 8,000 ; Western Australia, 2,000 ; and New South Wales, 500.

In Victorian agriculture, rye occupies only a minor place. Prior to 1940, it was sown mainly for green fodder purposes. Up to that time, the area sown was in the vicinity of 1,000 acres ; but since then the area has increased rapidly and in 1948–49, 16,606 acres were sown. This increase was due to the increased acreages sown in the Mallee, principally for soil-drift control purposes. Acreages sown to rye each year in Victoria for the period 1930 to 1947 are shown in the graph on the next page.

Rye has proved a suitable crop for early green feed, the purpose for which the Victorian crop was mainly used prior to 1940. The bulk of the area was sown in districts with cold winters.

Rye is not a satisfactory cereal for cutting for hay. The straw is very coarse, and there is a strong awn or beard on the head. Under Victorian conditions, the grain yield is not satisfactory. The rye plant is not self-pollinated, as wheat is, and under dry



The graph shows the big increase in the area of rye sown in Victoria in recent years. Most of this increased acreage is in the Mallee.

conditions wind-blown pollen may be dessicated before reaching the stigma of another plant. Under these conditions the number of grains set in each ear is low, and this, together with the small size of the grain, results in low yields.

It does not seem probable that rye will be cultivated in this country for its grain. In addition to its low yield, the prices that the grain could be expected to realize would not make its cultivation as profitable as that of the other cereals. As a feed grain it has a flavour that makes it relatively unpalatable to live-stock when fed on its own; it must, therefore, be fed mixed with other grains.

In the pattern of Victorian agriculture, rye is a special crop which, unless something unforeseen develops, will probably continue to be produced in relatively small quantities—chiefly for the control of soil erosion, and for early green feed.

VEGETATIVE CHARACTERS

The growth habit of rye (*Secale cereale*) is similar to that of wheat. In the seedling stage, rye can be distinguished from all other cereals by a reddish-purple coloration of the seedlings, and later by a similar color on the leaf sheath. The growth of seedlings is rapid, but in the early stages it tends to be spindly and appears less robust than other cereals. This is a critical period in the establishment of rye on sandy areas.

The stooling capacity of the young plants is high, and, although the early growth is prostrate, it is vigorous and the plant develops rapidly. It is this rapidity of early growth, together with an ability to stand up to sand-blasting, that makes the plant so valuable for sand-drift control under Mallee conditions. The plant is very drought resistant and will provide a covering of straw under conditions which would mean failure with other cereals. The coarse, tough straw breaks up more slowly than the straw of other cereals, providing a trash cover for a longer period.

During early growth, the crop is very palatable to all kinds of live-stock, but as the crop approaches maturity palatability decreases markedly. At this stage it is avoided by all stock if other feed is available.

The grain is smaller and darker in colour than wheat, and the crease in the grain is less prominent. The bushel weight is usually

Typical heads of rye (*Secale cereale*).

about 56 lb., although commercial trading is normally on the basis of 60 lb. per bushel.

RYE FOR DRIFT CONTROL

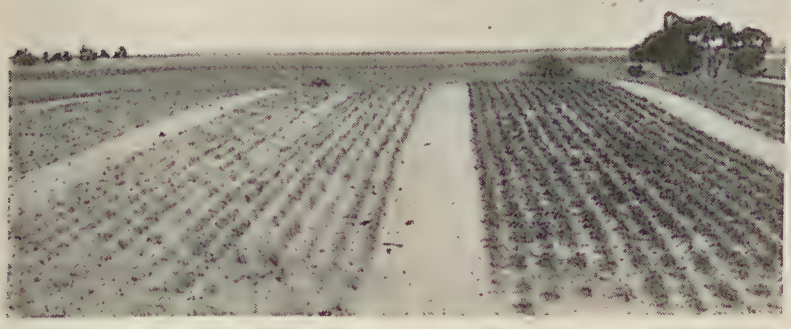
The blowing of sandhills which have been denuded of vegetative cover by overgrazing or other means is a very serious form of erosion in the northern Mallee. If attention is not given to such hills, they soon become either "razorbacks" or "weeping ridges" which cannot be worked by ordinary implements. This type of erosion is commonly found on land that has not been worked for several years, and causes serious and constant trouble to public utilities such as roads, railways, and stock and domestic water channels. Rye is a most useful crop on such areas.

A heavy crop of rye on light sand

The value of rye in retarding drift has been responsible for the rapid increase in acreage sown over the past few years. Of all cereals grown in Mallee areas, rye withstands the onslaught of sandblast best. On badly blown sandhills, loose sandbanks or on hills depleted of surface soil and fertility, where wheat or oats grow only a few inches high, or are completely blown out, rye will grow vigorously and may attain a height of 3 or 4 feet.

After a period of testing on the Mallee Research Station at Walpeup, supplies of rye seed were built up at that station. This was distributed to Mallee farmers, most of whom reported favourably on the crop. In 1943, the Department of Agriculture initiated demonstration areas to show the value of rye in stabilizing sand dunes and reclaiming wind-eroded areas. This work was later extended in collaboration with the Soil Conservation Board.

The preliminary work on each demonstration site before sowing consisted of ploughing up exposed hard patches or limestone areas where necessary, levelling of the hilltops in so far as was practicable, and the removal of stumps exposed by loss of topsoil. The whole area was then sown to rye. A standard seeding rate of 45 lb. of rye per acre was adopted, while a dressing of 50 lb. of superphosphate was used on the bulk of the area, but some strips were left without superphosphate. In all cases, the response to superphosphate on the demonstration areas was obvious, and was measured by sample harvesting.



Early growth of rye and oats. Left—Oats. Right—Rye. The stooling capacity of rye is high and the early growth vigorous.

The demonstrations showed that the formation of sharp ridges can be halted by the establishment of cover on the sides of the ridges. The top will then blow and accumulate in the cover on the sides, reducing the height, and making it possible for the tops to be sown in a subsequent season.

In the year following sowing, the bulk of the growth usually consists of self-sown rye. Wild turnip and ham-and-eggs daisy usually become the dominant species in later years. After a period of years, when the amount of useful vegetation is small or if the cover thins out, the area should be sown again to rye or fallowed, using special precautions to prevent drift, and then sown to wheat.

Owing to its value in stabilizing areas affected by wind erosion, the Soil Conservation Board has supplied rye and superphosphate free to farmers to stabilize drifting sand dunes. The Board has required from the land holders an undertaking not to permit stock to graze on the areas during the first season, nor to cut or burn the stubble. In each of the last four seasons, seed and superphosphate for the sowing of 3,000 to 4,000 acres have been distributed.

By sowing rye on light land adjacent to stock and domestic supply channels, the State Rivers and Water Supply Commission has successfully and profitably reduced the amount of sand which formerly drifted into these channels.

Rye can be used as a cover crop to prevent drift on fallowed land, but, except possibly on very sandy rises, it is not as good as oats for this purpose. An objection to rye as a cover crop is that it is difficult to control the grazing to prevent seeding. Tests at the Mallee Research Station indicate that a cover crop of rye depresses the yield of the subsequent wheat crop sown on the fallow to a greater extent than a cover crop of oats will do.

RATE OF SEEDING AND MANURING

When sowing rye to stabilize an area, it is important that the ground be covered with vegetation as quickly as possible, and that a large bulk of straw be obtained to give protection for several years.

TABLE 1.—RATE OF SEEDING AND SUPERPHOSPHATE TRIALS WITH RYE AT MALLEE RESEARCH STATION.

(*Average Four Years*, 1944–47.)

Treatment.	Yield.	
	Hay cwt./ac.	Grain bus./ac.
Rate of Seeding Section.		
Seed 15 lb. per acre	13·6	6·3
Seed 30 lb. per acre	14·8	7·1
Seed 45 lb. per acre	15·6	7·4
Seed 60 lb. per acre	15·8	7·6
Superphosphate Section.		
No manure	14·8	6·8
Superphosphate 30 lb. per acre ..	16·0	7·4
Superphosphate 60 lb. per acre ..	17·4	8·0
Superphosphate 90 lb. per acre ..	17·1	8·0

Tests have been carried out to determine the best rates of seeding and manuring of rye to achieve an efficient ground cover

Rye growing along the banks of stock and domestic channel near Ouyen.

and the maximum growth of straw. These trials, conducted at the Mallee Research Station over the period 1944–47, showed that a seeding rate of 45 lb. per acre and 50 to 60 lb. of superphosphate per acre can be recommended for erosion control. The results of the tests are set out in Table 1.

Samples taken in five Mallee districts in 1945, from comparable areas sown without manure and with 50 lb. of superphosphate per acre, showed that the hay yield was increased from 10 cwt. per acre when no manure was used to 30 cwt. per acre when a dressing of 50 lb. of superphosphate per acre was given. The yields of grain from these treatments were 3½ bushels and 8 bushels per acre respectively. The areas concerned in these tests were wind-eroded sandhills depleted of much of their fertility. In such circumstances the response to adequate dressings of superphosphate is probably much greater than on more normally cropped land.

Upper picture—This photograph of a sand dune was taken in 1941. Right—The same dune in 1943 stabilized with rye.

TIME OF SOWING

Soil and weather conditions from seeding until about a fortnight after germination are particularly important in the establishment of rye on loose sandy soil. During the first fortnight after emergence, young rye plants are spindly and delicate, but after that they stool out well and are most robust.

Sowing should be carried out under conditions that will enable the plant to get a good start and reach a "safe" stage as quickly as possible. Therefore, the sowing should be done as early as possible after the autumn break of the season, that is, as soon as conditions permit after the middle of March. Growth is more rapid when the soil is warm and, under such conditions, a cover sufficient to give protection against wind-blasting is obtained more quickly than later in the season. If sowing is delayed until May or June, soil conditions are colder, emergence and the obtaining of a good ground cover are slower, and the risks of failure are much greater than with early sowing.

Whenever possible, wet sowing should be practised, as seed sown in dry ground may be exposed or blown away before rain falls. To assist in giving protection to young seedlings, the surface soil should be left as well ridged as possible when the rye is sown. Such ridging, which can only be

obtained when the soil is moist, may be sufficient to protect young plants during the first windstorm after sowing.

RYE FOR GRAZING

As stated earlier, most of the rye grown in Victoria prior to 1940 was sown for early green feed. As early as 1936 rye was included in the cereal grazing trials at the Mallee Research Station, and its ability to make rapid growth on sandy soil led to its being tested on windblown sandhills where other cereals would not grow satisfactorily.

A heavy crop of rye in the Kulwin district.

In the grazing trials, two strains of rye were tested along with other cereals. Both strains gave more early green feed than oats, barley or wheat. Results of these trials are set out in Table 2.

With green fodder, palatability of the crop is important. In some years, at the early grazings, the sheep grazed all varieties of oats and rye evenly, but on other occasions the rye plots were eaten bare before the oats were eaten, indicating that rye in its early stages of growth is very palatable. At the late grazings rye, which commences upright growth early and quickly becomes coarse and stemmy, was definitely unpalatable.

With regard to nutritive value, chemical analyses carried out by the Chief Chemist of the Department showed that rye, at the early grazings, compared favourably with other cereals with respect to total protein, but the percentage of carbohydrate plus fat was lower than oats or barley.

TABLE 2.— YIELD OF GREENSTUFF FROM VARIOUS CEREALS, MALLEE RESEARCH STATION.

(*Yields Standardized to* 80 *Per Cent. Moisture.*)

Variety.	July Grazing.	Early September Grazing.	October November Grazings.	Total Grazing.
	Average Three Years, 1939–41.			
	cwt./ac.	cwt./ac.	cwt./ac.	cwt./ac.
Dawn Oats ..	10·0	11·6	14·3	35·9
Cape Barley ..	7·9	10·9	18·4	37·2
Rance 44 Wheat	8·5	9·9	15·9	34·3
Black Winter Rye	11·0	13·8	18·5	43·3
South Australian Rye	12·4	11·6	18·2	42·2
	Average Ten Years, 1939–48.			
Dawn Oats ..	11·5	12·7	15·3	39·5
South Australian Rye	11·9	14·3	16·6	42·8

Rate of seeding with rye. Left—15 lb. per acre. Right—60 lb. per acre.

Rye for fodder should be regarded purely as a green-feed grazing proposition. Although it recovers well after early grazing, neither the hay nor the grain produced is as attractive as that obtained from oats.

When rye is sown to stabilize sandhills,

it should not be grazed. Rather it should be allowed to produce the maximum growth of straw.

VARIETIES OF RYE

Unlike wheat, oats, and barley, rye is normally a cross-pollinated plant, and different varieties sown together soon become mixed. Because of this, and because of the fact that rye has occupied such a small place in Australian agriculture, little work concerning rye varieties has been undertaken in this country. Varieties tested at the Mallee Research Station include South Australian, Black Winter, Balboa, Slav, and a number of varieties imported from overseas.

South Australian rye is an early-maturing type, with fast early growth. It appears that this variety has been produced by natural selection over a long period in the rye districts of South Australia, and is thus well suited to Mallee conditions, particularly for sowing on sandy areas.

The variety Slav also makes fast early growth, and is of similar maturity to South Australian rye.

Black Winter is of later maturity. It has a greater stooling capacity than South Australian or Slav, and is the variety most commonly grown for green feed in southern Victoria.

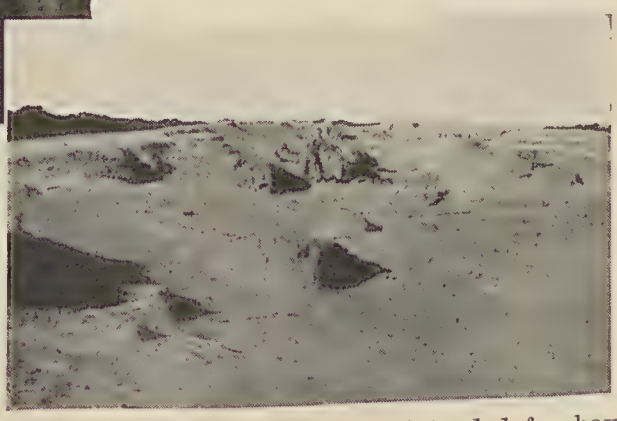
Balboa rye was developed in Missouri as a fast-growing green fodder type. Its growth type and maturity are similar to Black Winter.

The varieties imported by the Department of Agriculture from Canada, northern United States of America, and northern Europe, generally have proved too late and too slow in early growth for Mallee conditions.

The most important disease of rye is ergot (*Claviceps purpurea*), but it has not been noticed in the Mallee. Feeding stock with ergot-infected grain can cause serious losses because of its poisonous properties. Ergot has certain medicinal uses, and, because of the difficulty of importing it during the war, rye was grown in some southern districts to provide a "crop" of ergot.

FEEDING RYE HAY AND GRAIN TO STOCK

It has already been pointed out that rye hay and grain are inferior to hay and grain produced from other cereals. However, in drought years it may be possible to cut rye hay when other areas intended for hay are too short, and surplus rye grain after harvesting can be utilized for stock food.



Left—A sandhill stabilized with rye-corn.

Below—The same hill prior to levelling and seeding with rye.

The best quality rye hay is obtained when the crop is cut at the flowering stage, before the stems become too harsh and woody. Its food value in such a condition is roughly equal to wheaten hay which has been cut at the same stage of growth, and it can be

fed safely on its own, or mixed with other roughages. The feeding value of rye hay is lowered by the presence of the awns in the ear.

Rye straw is seldom used as a foodstuff, but it is particularly useful for thatching. It is also suitable for bedding down livestock.

The food value of rye grain is roughly equal to that of wheat or barley, but, when fed in large quantities, is less palatable. However, this disadvantage can be largely overcome by mixing the grain with better-liked concentrates so that it forms only part of the concentrate mixture. Sheep eat the grain more readily than horses, cattle or pigs do, and the sheep can be fed with rye without the addition of other grains or concentrates. Except when fed to sheep, the grain should be ground to a fine but gritty texture. Rye used as stock feed should be free from ergot.

To supplement the limited local knowledge concerning rye grain as a stock food, and to ascertain its value in comparison with wheat, the Department of Agriculture, in 1946, conducted an experiment in feeding rye to "fattening" pigs at the Rutherglen Research Station.

In the experiment, three even lots, each of fourteen pigs with an average live-weight of 97 lb., were given one-third of a gallon of separated milk daily for each pig and allowed free access to self-feeders containing crushed grain. Lot 1 received crushed rye; Lot 2 crushed wheat, and Lot 3 a mixture of equal parts of crushed wheat and crushed rye.

After 99 days on these foods, the average live-weight of the pigs fed on rye grain increased by 81 lb., the average live-weight of those fed on a mixture of rye and wheat increased by 109 lb., while those fed on wheat as the sole grain showed an average increase of 115 lb. These results indicate that rye is suitable for feeding to pigs, but is not as good as wheat for this purpose. It gives more satisfactory results when fed in combination with wheat.

SUMMARY

Rye is the most satisfactory cereal for stabilizing loose sandhills in the Mallee. For this purpose, rye should be sown as soon after the middle of March as weather conditions permit. Seeding rates of approximately 45 lb. to 50 lb. per acre, and fertilizer rates of 50 lb. to 60 lb. per acre of superphosphate give satisfactory results. Such a crop should not be grazed.

Rye may be used as a grazing crop. It provides more early feed and a greater total quantity of greenfeed than other cereals, but is not as suitable as oats where the crop is allowed to recover and produce a grain yield after being fed off in the early stages of growth.

A strain of rye which appears to have developed by natural selection in South Australia is recommended for Mallee sowings.

Rye grain as a stock food is best utilized in combination with other grains such as wheat. When so used it is a satisfactory food.

Book Review

Growth Substances and Their Practical Importance in Horticulture by H. L. Pearse, obtainable from technical bookshops or from the C.A.B. Liaison Officer, 314 Albert Street, East Melbourne, C.2. Price 15/8.

Improved orchard and garden practices based on the use of synthetic growth substances are rapidly being adopted in Australia, yet most growers of fruit, vegetables and flowers know little of the materials employed or of the principles underlying their use.

The Commonwealth Bureau of Horticulture and Plantation Crops has recently issued a comprehensive publication describing the discovery of growth substances and their development for such diverse practical purposes as stimulating rooting of cuttings, preventing sprouting in stored potatoes, increasing fruit setting in tomatoes, control of flowering in pineapples, and killing weeds. Though the book goes beyond the needs of the practising horticulturist in its treatment of the historical aspect, ample space is devoted to practical recommendations, which are clearly given.

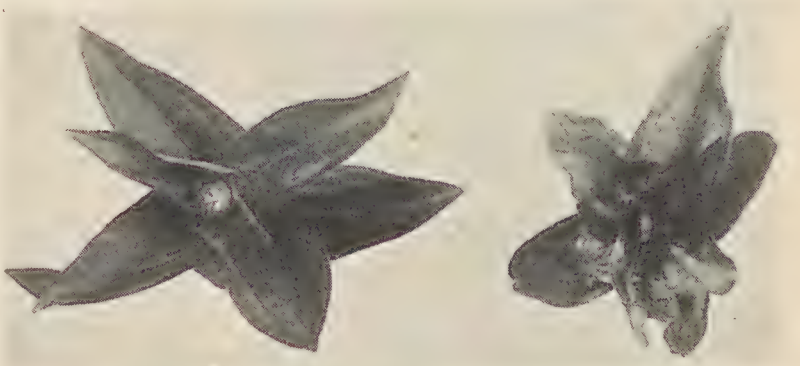
Garden Notes for November

By George Hyam, Horticultural Supervisor

THE FLOWER GARDEN

Zinnias are Sun-loving Plants

ZINNIAS, being natives of the warm drier areas of Mexico, are particularly suitable as summer bedding annuals in all parts of this State. They are adaptable to almost any well-drained soil if they are planted in full sun, but do best on loamy soil or soil which has been made friable by the addition of organic manure. Zinnias transplant readily but as their seed is large, it is easy to sow them direct on the planting sites.



A healthy zinnia, and one infected with spotted wilt.

Although hardy, there are a few points in their cultivation which should receive attention, so as to get the best results and to avoid those sudden failures which frequently occur in individual plants. Zinnias respond to soils that have been limed, and for this reason they are suitable to follow spring-flowering stocks or wallflowers. Lack of lime and perhaps, too acid soil, is thought to be a cause of the species of mildew which sometimes attacks them. The fairly sudden yellowing of the leaves, particularly when the plants are young, and the subsequent wilting of the plant is now recognized to be the same disease as the spotted wilt which is so troublesome on tomatoes.

As in the case of tomatoes, planting too early and before the soil is sufficiently warm, increases their susceptibility to this disease and as there is no cure for zinnias so affected, they should be pulled out and destroyed at the first sign of attack. Preventive treatment is the same as for tomatoes, i.e., the control of insects likely to transmit disease. Thus occasional sprayings with DDT or H.E.T.P. should be given. The yellow jassid or canary fly should be watched for and sprayed as, even if it does not transmit disease through the absence of affected plants, its sucking debilitates the plants and spoils the flowering.

Young zinnias tend to grow up to a single stem and although this flower is often large, it is best to pinch out this first bud to make them stool out to several stems. Zinnias do not require heavy feeding. A light dressing of about 1 oz. per square yard of blood and bone applied at the time of sowing is sufficient as a base manure, but afterwards, the plants should be mulched. When in bud, fortnightly applications of weak liquid manure will improve the size of the flowers and brighten their colour. Partially or fully grown zinnias which droop suddenly without much discolouration of the foliage are usually attacked at the roots by a type of nematoid eel-worm that is invisible to the naked eye. Such plants should be removed immediately, and it is not advisable to plant zinnias on the same soil for a year or two unless a soil fumigant has been applied. Zinnias of all kinds can be planted or sown from November to January, the autumn flowers usually being of the highest quality.

Single chrysanthemums for garden display

Of recent years, chrysanthemums as bedding plants seem to have been somewhat eclipsed by dahlias and other brighter coloured autumn flowers. However, they can still hold their own as the best late autumn flower, particularly in large gardens where they can be given ample space. They are most suitable for growing in country gardens in any part of the State. For

general garden use, the now vastly improved single varieties are best. They require less attention to bring them to near-perfection, and their longer period of flowering which starts in summer, and their merits as cut flowers have greatly increased their popularity.

As for the Japanese double-flowering types, rooted cuttings should be struck or purchased and planted annually. The previous season's crowns will never produce such good or abundant flowers if these are just left to grow on. Although chrysanthemums can be planted well into December, the October or early November planting is best, especially for single varieties. For these, no special soil preparation is necessary and they can be dot-planted amongst other summer annuals. However, as too much watering in the early stages is not desirable, it is better to plant them in separate beds. Excessive nitrogen should be avoided and for single varieties under garden conditions, a dressing of 1 oz. per square yard of market gardeners' fertilizer makes a good base manure, followed by liquid manure applications when they are flowering.

All chrysanthemums prefer a firm soil around their roots, so that, when planting, the soil should be trampled firmly around them. "Stopping" and the thinning of buds is an important operation in the production of good flowers on the double varieties, especially if these are to be exhibited, and a modification of this work should be applied to any garden chrysanthemums, including the singles. Newly-planted chrysanthemums quickly grow a tall single stem terminated by a flower bud which does not open. This is known as the stop-bud which normally causes branching from below it, but if side shoots have not appeared by the end of the month, the growing point should be nipped out when the plants are about 8 inches high. Singles can be allowed to develop up to 24 branches, the removal of surplus shoots being continued as the plants grow. Apart from a light disbudding at flowering time, there is no need to apply the rather elaborate "stopping" required to produce good flowers on the Japanese varieties. Singles can be allowed to flower at any time; cutting off the blooms as they fade, or for vases, will keep the plants flowering throughout the season.

THE VEGETABLE GARDEN

Tomato Planting

LATE October and early November is early enough to plant out tomatoes in home gardens in most parts of the State, other than the northern areas. As tomatoes always repay special attention in the form of staking, pruning and spraying, the principle should be to plant out fewer plants and look after them well rather than plant a larger number and let them trail over the ground aimlessly.

About 18 to 24 well-tended plants will provide ample for the average family needs and these should be planted in three lots, early, medium, and late. The advantage of raising one's own plants was stressed in the August vegetable notes which appeared in the July Journal, but if this has not been done, and seedlings have to be purchased, the following procedure will reduce the risk of loss after planting. Select sturdy, dark-leaved plants that are not "leggy" and drawn, as these will be well-hardened off. A good plan is to purchase about twice as many plants as you will need for the one planting, and then plant two seedlings about six inches apart to one planting site. Watch their growth closely, and in a fortnight's time remove the weakest plant or any that show the least abnormality. Plant a little deeper than the original soil mark, and water in the plants with a nutrient solution made from ½ oz. of sulphate of ammonia or nitrate of soda and 1 oz. of superphosphate to 2 gallons of water. This is best made up 48 hours before use.

Newly-planted tomatoes should not be forced with too abundant watering or manuring—other than the base manure applied before planting—until they come to the flowering stage. If the seedlings are planted in soil well soaked the day before planting, they rarely need more watering for at least a fortnight. The aim should be to keep the soil moist and not soaked.

Stakes should be inserted before planting, and as soon as the seedlings grow to a height of 8 or 10 inches make the first tie. This should be fairly loose so as to allow for the expansion of the stem. As soon as the plants establish, give them the first insecticidal spraying or dusting and continue applications at about fortnightly intervals until the end

of January. H.E.T.P. preparations gave good results last year and DDT has been satisfactory if applied at the proper strengths. Fungicidal sprays or dusts can be applied to advantage but it should be realized that the best control for disease on growing tomatoes is the prompt removal and destruction of affected plants, and the control of insects which convey disease. Don't overcrowd tomato plants; they need air and light around them. There should be 2 feet between staked plants in the row, and at least 3 feet if left unstaked. A mulch spread round the growing plants is very desirable.

The main crop of root vegetables

Although there is an extended planting season for all root crops, November and December are considered the best months to sow the long-keeping and slow-maturing kinds like carrots and parsnips. Beetroot sowings are better made in small lots over a longer period, as the consumption is not so great, and young beetroot is much superior to older and larger roots. The present sowing of carrots and parsnips will be usable from late January and will store in the ground in good condition until the following August. Carrots will never do well in other than friable soil, and plenty of compost or old horse manure should therefore be dug in along the rows if planted in heavy soil. Avoid fresh manure, otherwise their roots will fork.

Even in sandy soils, the addition of organic manure is desirable for carrots unless it has been heavily manured for a previous crop, so as to make it more retentive of moisture. Parsnips will also do best under similar soil conditions but unlike carrots, they prefer soils of low acidity and with a lime content. Beetroot is more adaptable as to soil texture, but a similar soil preparation will suit it

TOMATO PLANTING AND STAKING

1. Take up some soil with each plant. Use a trowel to make holes. Firm the soil around each plant, and water gently with nutrient solution.
2. After staking cut out the secondary branches between the leaf and the main stem. Handle the plants carefully to avoid damaging tender leaves and stems.
3. Tie the stems loosely to the stake so that the twine will not cut into them as they grow larger. Use soft twine with some "give" to it.
4. Staked tomatoes produce clean fruits, easy to pick.

[After Home Veget. Gardening, Circ. 26, Univ. of California.

well. The best fertilizer for these roots in average garden soil is superphosphate at the rate of 1 oz. per yard of row, placed in double bands as described in the September Garden Notes (August Journal). In the poorer soils, the 5. 1. 1. complete fertilizer could be used to advantage instead.

Hot winds and heat, occurring at the time when these root crops are germinating, sometimes cause a bad strike. Under garden conditions, planting at the bottom of a shallow drill about 2 inches deep will help, as its sides give some protection. The seeds are covered with the usual ½ inch of soil. A light mulch of some coarse material over the seed row also lends protection, and for the first week or two after sowing, the plot should receive frequent waterings, reducing the intervals as the roots grow. Another good practice is to sow root crops at this time between rows of beans which have been given a little extra spacing, for the purpose of giving the young plants shelter. In summer, all root crops should be thinned at an early stage, watering beforehand, and again after thinning to settle the soil around the roots of the remaining plants.

Other November work

The prompt removal of weeds in summer crops is important as these are one of the causes of excessive loss of soil moisture. This should be done by shallow chipping with the Dutch hoe as soon as they appear through the ground. Deep cultivation should be avoided during the summer months as most summer plants form at least part of their roots close to the surface, and deep cultivation is known to increase the rate of evaporation of soil moisture. Mulching vegetable beds in summer not only allows applied water to soak in better but protects shallow roots from excessive heat, suppresses weeds, and finally, adds some humus to the soil when dug or ploughed in later.

Limited amounts of potash in the muriate form are now available to gardeners. Applied in the form of a liquid solution made at the rate of about 1 oz. per gallon, with or without a similar quantity of sulphate of ammonia, will benefit growing crops of lettuce coming into heart, beans, and tomatoes about to set, especially if no complete fertilizers were used beforehand. In sandy soils, this can also be applied to growing root crops to some advantage.

Potash is an important element for asparagus when applied as liquid manure in combination with sulphate of ammonia during the cutting season. Potash however, should be used with some discretion, and any potash dressing should be light—not exceeding 1 cwt. per acre, or about ½ oz. per square yard under garden conditions, at any one time.

TUBERCLE-FREE HERDS

ACCREDITED TUBERCLE-FREE HERDS

The following herds have been declared free of tuberculosis under the *Accredited Tubercle-free Herd Scheme* conducted by the Department of Agriculture. Under this scheme a tubercle-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests or upon disclosure of infection, three semi-annual, successive, physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

Name.	Address.	Number in Herd.
Aboriginal Station ..	Lake Tyers ..	108
Ampt, E. W. ..	Gymbowen ..	8
Ballarat Orphanage	Ballarat	151
Banyule Stud Pty. Ltd.	Wangaratta ..	79
Beggs, A. R. ..	Beaufort	116
Black, I. S., Estate of	Mount Noorat ..	65
Bleakley Bros. ..	Horsham	14
Bott, J.	Yarrawonga ..	39
Bruhn, C. H. and V. I.	Mirboo North ..	54
Callahan, M. ..	Barwon Downs ..	34
Callahan, Philip ..	Barwon Downs ..	85
Candler, G. E. ..	Hamilton	35
Carne, W. J. ..	Pakenham Upper ..	30
Carson, M. E. ..	Irrewillipe East ..	86
Cason, J. M. ..	Lima South ..	63
Clark, P. W. and Son	Whittlesea	95
Clark, W. J. ..	Monomeith ..	142
Cowan, G. L. S. ..	Bacchus Marsh ..	61
Cox, F. G. ..	"Birradale," S. Lyndhurst	47
Cribbes, T. ..	Wangaratta ..	40
Deering, J. T. ..	South Wangaratta ..	79
De La Rue, N. C. ..	Tomahawk Creek ..	69
Dookie College (Ayrshires)	Dookie	124
Dookie College (Herefords)	Dookie	38
Drechsler, W. P. ..	"Berry Bank," Swan Hill	102
Dunmore, T. J. ..	Melton	23
Eagle, W. H. ..	Womerah	31
Everist, F. ..	Tyabb	10
Fixter, A. ..	Boisdale	26
Foletta, G. G., and Son	Buxton	159
Fraser, S. T. ..	Tomahawk Creek ..	52
Geelong Grammar School	Corio	82
Gilbert, J. A., and R. D.	"Brockelbank," Yinnar South	108
Gilmour, D. W., and N. B.	St. Hubert's-lane, Yering	102
Gleeson, P. J., and Son	Tynong	216
Goddard, James H., and Sons	Cora Lynn ..	104
Gorman, A. W. ..	"Cathcart," Alexandra	94
Griffiths, J. G. ..	Benalla	121
Gross, Mrs. G. F. ..	Horsham	37
Hamilton, A. ..	Flinders	104
Hartley, C. G. ..	Dandenong ..	117
Hartwick, J. P. ..	Hamilton	26
Haywood, A. R. ..	Mordialloc	184
Hicks, E. J., and Sons	Echuca	100
Howell, G. G. ..	Wollert	130
Howlett, E. and G.	Lang Lang ..	84
Ivone, M., and Sons	Ovens	103
Jackson, H. ..	Lockington ..	81
Johnson, F. G. ..	Horsham	42
Jones, A. C. ..	Barnawatha ..	182
Keele, H. A. ..	Bamawm	79
Kelynack, P. T. ..	Bundoora	83
Kemelfield, J. ..	"Wongala," Woodend	46
Kemp, E. J. ..	Horsham	15
Kingsley-Newell, F. J.	Shoreham	60
La Fontaine, G. ..	Mitta Mitta ..	61
Lawrence, P. H. ..	"Rainga," Tarrawarra	89
Lawton, W. ..	Frankston	56
Light, D. T. ..	Noradjuha	8
Longerenong Agricultural College	Dooen	50
Ludeman, L. C. ..	Ayrford, via Timboon	74
Luke, K. G. ..	Romsey	32
Maloney, P. J. ..	Tongala	91
Maybery, A. H. ..	Mitre	18
Meaklim Bros. ..	Mooroopna North ..	74
Middleton, J. A. ..	Labertouche ..	80
Moore, J., and Co.	Yarram	72
Morton, R. S. ..	Kerrie	36
Myers, J.	Myrniong	76
McIntosh, J. ..	Merrigum	77
McKenzie, E. ..	Kerang	68
McKenzie, Mrs. E. J.	Woodford	59
McKenzie, H. P. ..	Trawalla	23
McNabb, G. A., and Son	Irrewillipe East ..	191
McPherson, A. L., and J. J.	Kyneton	95
Nancarrow Bros. ..	Kerang	57
Newton, J. M., and Sons	Whorouly	63
Nicholas, M. A. ..	Sherbrooke ..	79
Noonan, Mrs. S. A.	Benalla	62
Northcote Children's Farm	Bacchus Marsh ..	64
Payne, A. E. T. ..	"Yarra View," Lilydale	78
Payne, T. E. N. ..	"Woodburn," Kilmore	73
Poole, M. A., and D.	Caldermeade ..	143
Poole, M. A., and D.	Yannathan ..	103
Potter, W. J. ..	Longwarry North ..	125
Prosser, J. E. ..	Ondit	40

TUBERCLE-FREE HERDS—*continued.*

Name.	Address.	Number in Herd.
Read, executors, Estate I.D.	Springhurst ..	99
Rix, A. A. ..	Officer	92
Roe, Thomas H. P.	Cobram	15
Sanderson, R. F. ..	"Pleasant Hill," Kyneton	87
School of Horticulture	Burnley	7
Scott, A. L. ..	"Wolonga," Kongwak	43
Selwyn-Scott, F. E.	Scotsburn	66
State Experiment Farm.	Rutherglen ..	55
State Research Farm	Werribee	203
Stephens, Dr. F. ..	Vermont	34
Tanner, F. V. ..	Peterborough ..	39
Thomas and Taylor Pty. Ltd.	Hamilton	26
Thompson, H. D. L.	Merricks	41
Till, J. A. ..	Tongala	58
Tucker, E. G. ..	Horsham	30
Vagg, T. R. ..	Officedale	56
Vagg, F. G. ..	Leongatha	57
Warnock, J. A. ..	Lima South ..	103
Waterhouse, H. W., and Son	Pakenham	70
Watson, R. G. ..	Frankston	21
White, J. C. B. ..	"Challicum," Buangor	87
Williams Victoree Farms	Dalmore	203
Williamson Bros. ..	Carisbrook	119
Woori Park Pty. Ltd.	Woori Yallock ..	127

In addition to the above the following is a list of herds in their respective districts which have given negative reactions to two or more successive tests conducted by departmental veterinary officers, but, inasmuch as replacement cows are only submitted to one test before being admitted to the herds, they cannot be considered as accredited under the Accreditation Scheme which requires, among other things, that no cow shall be admitted to the herds unless it has given two (2) negative reactions at an interval of 60 days, and must be kept in isolation during the period between the two tests.

District.	Herds.	Cattle.
Ararat	11	291
Bairnsdale	5	326
Ballarat	126	3,296
Benalla	45	511
Bendigo	96	3,682
Broadmeadows	52	2,514
Colac	11	345
Doncaster	13	604
Geelong	106	3,903
Hamilton	5	324
Heidelberg	19	572
Horsham	13	650
Morwell	2	202
Orbost	1	107
Portland	7	431
Rutherglen	20	296
Sale	7	532
Terang	1	10
Traralgon	4	218
Wangaratta	38	475
Warrnambool	8	445
Whittlesea	104	4,877
Wonthaggi	7	386
Yallourn	4	268
Yarragon	36	1,630
Yea	26	73

There are also 404 herds in which 16,626 head of cattle have passed one test and may be considered, therefore, to be in process of becoming tubercle-free herds.

CERTIFIED PULLORUM-TESTED FLOCKS (POULTRY)

A certified Pullorum-Tested Flock is one in which all stock over six months of age have given a negative reaction to the agglutination test for Pullorum Disease, and in which all such stock are kept under rigid conditions of isolation approved by the Chief Veterinary Inspector.

The undermentioned flocks have been certified by the Department of Agriculture, and will remain so for the current calendar year, or until such time as the Chief Veterinary Inspector determines.

Application forms are obtainable from the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

Particulars of breeds of birds tested are as shown hereunder:—

A. Australorp; B. White Leghorn; C. Rhode Island Red; D Sussex; E. Langshan; F. Brown Leghorn; G. Buff Orphington; H. Black Leghorn; I. Minorca; J. Ancona; K. Legbar; L. Indian Game.

Owner.	Breed.	Number of Birds.
Agricultural College, Dookie	A, B	1,726
Anderson, G. M., Greensborough-road, Macleod	A	1,488
Anguey, H., 138 Hargreaves-street, Castlemaine	A, B	725
Arnold, J. B., Terrara-road, Vermont	A	810
Ashgrove Poultry Farm, Cockatoo	A, B, C, D	3,035
Baker, J., Greensborough	A	1,077
Barastoc Experimental Farm (G. Lee Manager), Croydon	A. B, C	716
Bassett, R. A., South Muckleford	A, B	345
Bayfield, A. E., Seven Acres Poultry Farm, Springvale	B, C	1,374
Bingley, A., 333 Highbury-road, Burwood	A, B	2,108
Bird, F. V., Middlebro-road, Box Hill	A	323
Bishop, Mrs. P. M., Springvale-road, Springvale	A, B, C,	1,810
Boyce, A. D., Springvale-road, Forest Hill	B	1,097
Bray, J., 18 Hotham-street, Warrnambool	B	140
Brumby, W. E., Ellendale-road, Noble Park	A, C	438
Burney and Pound, North-road, Langwarrin	A, B	1,731
Cannings, P. G. A., Shepparton East	B	3,932
Carlella Poultry Farm (J. W. Stoneman), Campbell's-road, Briar Hill	C, F	272
Cashin's Poultry Farm, 2 Dawson-street, Stawell	A, B	2,528
Chalmers, H. L., 9 Lefevre-street, Spotswood	B, F, K	582
Chamberlain, L., Nathalia	A, B	1,984
Chapman, Mrs. E., Youanmite	A, C	282
Christie, R. R., and Son, Tucker-road, Bentleigh	A, B, C	879
Cole, R., Mooroopna	B, C	416
Collins, A. J., Emerald	A, C	354
Colquhoun, Dr. W. L., "Aringa," Ringwood	A, B	195
Cook and McKnight, Croydon	A	1,568
Corbett Bros., Torbay-street, Macleod	A	2,318
Coupar, J. E., Box 18, Nathalia	A, B, C	388
Davidson and O'Keefe Hatchery (Mrs. M. H. Turner, Prop.), 22 Sherwood-avenue, Ringwood	A, B	75
Davies, L. F., Westall-road, Springvale	A, C	1,368
Davis, C., Tarilta	A, B	866
Davis N. W., Mickleham, via Broadmeadows	A, B	3,089
Dawson, R. G., Maldon-road, Castlemaine	B	1,285
Day, L., Box 39, Kyabram	A, B, C	1,778
Deakin, J., 21 Troy-avenue, Bonbeach	A, B	301
De Gruchy, Mrs. F., 56 Kingsville-street, West Footscray	C	50
Dobson, W. "Carramar", Whittlesea	C	143
Dugan Bros., Broadmeadows	B	8,864
Ellen J. Rossmoyne Pig and Poultry Farm, Avoca	A, B	1,919
Emmott, J. T., Verdon-street, Inglewood	A, B	293
Farmer, C. R., Whitehorse-road, Ringwood	A, B, C, D, K	2,260
Fellows, J., Yan Yean-road, Plenty	A, B, C	859
Fitchett, C. W., Spring Vale-road, Tally Ho	A, B	1,484
Fletcher, J. H., "Homeleigh," Tallygaroopna	B	1,621
Ford, J. V., 11 Barkers-avenue, Shepparton	A, B, C	1,026
Fraser, R. A., and Son, Colchester-road, Kilsyth	A, B, C	947
Frye, I. H., Grimshaw-street, Watsonia	A, B	1,937
Gedye Bros., Railway-road, Blackburn	A, B	3,775
Giarrusso, G., Lower Dandenong-road, Braeside	B, C	462
Gibbs, A. E., Stanhope	A, B	3,734
Gibbs, J. L., Lower Plenty	A, B	983
Graham, C., All Black Poultry Farm, Portarlington	A	50
Grenville Poultry Farm, Springvale-road, Springvale	A, B, C	3,666
Guy, J., "Murlea," Murgheboluc	A, B, C	670
Gwyther, R. P., "Woorrayl," Highton	A, B	1,144
Hamblin, N. A., Sunny Hill Poultry Farm, Toolleen	A, B	3,423
Hanson, S., Kilmore	A	237
Harrington, G. W., Springvale-road, Tally Ho	B	1,836
Harrington, W. H., Woodward-street, Golden Square	A	1,597
Harrison, A., Shenfield-street, Cobden	A, B, C, D	300
Hayes Bros., Mount Dandenong-road, Montrose	A, B	3,564
Henderson, C. W., Shepparton	A	395
Henderson, W. R., 22 Chesterville-road, Cheltenham	A, I	254
Hewett, A. T., Central-avenue, Croydon	A, B	866
Hopkins, C. A., and Sons, Success Poultry Farm, Knight-street, Shepparton	A, B	1,656
Hunt, R. R., 365 Highbury-road, Burwood	A, B	1,298
Hurst. B. H. G. (Mrs.). New-street, Eltham	B	2,768
Ikin, E. J., 44 McKay-street, Seddon	C	86
Inglis, W. J., Cobham-road, Mitcham	A, B	530
Jackson, Miss E. M., 4 Monash-street, Box Hill	B	48
James, D. E. and K. D., Spring Gully, via Bendigo	A, B, C	1,127
Johnson, A. S., Burwood-road, Ferntree Gully	A, B, C	2,282
Kay, V., 12 Wellington-street, Blackburn	A, B	2,634
Kennealy, W. R., Hallam-road, Hampton Park	A, B	1,503
Kennedy, F., Ferntree Gully-road, Glen Waverley	A, B, C	677
Kerr J. J., Clarke-road, Springvale	A, B	2,052
Kostos Bros., Oakleigh	A, B, C	473
Lang, J. L., 46 Dundas-street, Thornbury	E	104
Lattimore, A. G., Kilsyth	A, B, C	817
Lechte Bros., Dondardon Poultry Farm, Mount Waverley	B	2,175
Lintermans, W. A. J., Major-road, Lysterfield	C	1,160
Longerenong Agricultural College, Dooen	A, B	720
Lonie, R. A., 1 Chanak-street, East Malvern	A, B, C	37
Lucas and de Molnar, 4 Downong-street, Blackburn	A, B	1,639
Magnusson, L., Nathalia	B	936
Maher, A. E., Wal Wal	A, B	765
Major, C. D., Simpsons-road, Eaglehawk	A, B	2,000
Marshman, A. R., Archie's Creek	A, B, C	767
Maytime P. Farm, (R. J. O'Brien, Prop.) Watsons-road, Glen Waverley	A, C	694
McCabe, R., Gladstone-road, Dandenong	A, B, D	2,079
McCann and Sons, Crowlands-road, Stawell	B	4,198
McEwan, A. W. H., Whitehorse-road, Ringwood	A, B, K	157
McLauchlan, D. F, Rossiter-road, Koo-wee-rup	A, B	2,500
McTighe, C. H., Nar-Nar-Goon	A	571
McVay, A., Kernot-street, West Spotswood	A. B	2,506
Mead, J. L., 28 Golf Links-avenue, Oakleigh	A, B	254
Mills, J. J., Kelvinside-road Noble Park	C	267
Mold Bros., Banbury Park Poultry Farm. Old Narre Warren-road, Emerald	A, B	1,141

CERTIFIED PULLORUM-TESTED FLOCKS (POULTRY)—*(continued)*.

Owner.	Breed.	Number of Birds.
Molsons White Leghorn Stud (G. Durkin, Man), 188 Surrey-road, Blackburn	B	1,311
Moran, S. G., Glenburnie-road, Mitcham ..	A, B	732
Moroney, J. B., Kangaroo Flat	B	1,150
Mumford, L. J., Healesville	A	400
Neal, J. H., 18 Watt-street, Spotswood ..	L	22
Niewand, F. J., "Kalang," Lubeck ..	A, B, C	1,275
O'Brien, R. J., Watson-road, Glen Waverley	A, C	694
Paton, W. S., Glenburnie-road, Mitcham ..	A, B	477
Poulton, A. W., Vickers-street, Sebastopol	A, B, C	2,321
Rae, J., Albert-street, Sebastopol ..	B, C	1,889
Ranleigh Poultry Farm (D. H. Tokimosa, Prop.), Dingley	A, B	743
Ridge and Son, 42 Myrtle-grove, Blackburn	A, B, C	3,045
Robinson, W., 11 Olive-street, Hampton ..	B, C	1,029
Rose, H., Yarrambat	B	583
Rowe, Mrs. L. M., "The Wattles," Wal Wal	A, B	319
Salmond, J. B., Deer Park	H	246
San Miguel, M. H. (Mrs.), Woodhouse-grove, Box Hill	A, B	1,896
Scales, J., West Wattle Tree-road, Boronia..	A	1,492
Settle, J. H., Stanhope	A, C	2,491
Simpson, G. D., May-road, Glen Waverley ..	B	2,928
Smith, A. W. and M. P., Terang Poultry Farm, Terang	B	969
Smith, F., Lenham Poultry Farm, Terang	A, B	3,307
Smith, H. A., Marong-road, Maiden Gully ..	A, B, C	1,196
Snodgrass, R., Pakenham East	B	1,352
Stant, W. J. and F. E., Westall-road, Spring Vale	A, B, C	2,957
State Research Farm, Werribee	A, B	2,062
Stewart, J., Maldon-road, Castlemaine ..	A, B	565
Stewart, P. D., Bayswater-road, Croydon ..	A, B	1,028
Streeter, H. A., Avoca	B	508
Swift, D. A., Kangaroo Flat	A, B	2,313
Taylor, H. L., 180 Surrey-road, Blackburn..	A, B	1,389
Taylor, H. R., Rosebank Poultry Farm, Reservoir	A, B, C	5,357
Taylor, R. H., 132 Rathgowan-road, Reservoir	A, B, C	3,730
Teitz, G., 21 Kingsley-crescent, Mont Albert	B	736
Thomson, S. R.. Bacchus Marsh-road, Corio	A, B, C	1,543
Voigt, A. H., Sunnyside Poultry Farm, Follett-road, Cheltenham	A, B	1,412
Waiting, T. F. Scoresby-road, Bayswater ..	A, B	1,225
Walton, F. R., Woodvale-road, Boronia ..	A, C	707
Wandong Poultry Farm (Mrs. M. E. Trembath), Lawn-road, Noble Park	A, B	1,512
Webb, A. E. H., Frankston-road, Cranbourne	A, B	5,653
Welch, T. A., Bayswater-road, Croydon ..	A, B	3,062
Wesley, J. H., "Fairview," Kangaroo Flat	A, B, C	1,210
Williams, V., 91 Tone-road, Wangaratta	A, B	778
Winter, G. A., "Denehurst," Murgheboluc	A, C	355

CHECK UP ON HARVESTING MACHINES

The complete reversal of outlook for next harvest prospects brought about by the timely rains recently experienced in Victoria and other wheat and hay-growing States in Australia, has raised acutely the question of increased supplies of power and harvesting machinery to handle the forthcoming crop.

Although strenuous efforts are being made to obtain maximum supplies of tractors and harvesting machinery, there will not be enough tractors, binders, presses, or harvesters to go round. Consequently, farmers should endeavour to have their machinery in the best possible condition to face the harvest. Manufacturers have arranged to give the supply of spare parts the highest priority in their factories and to do everything in their power to help recondition old machines for farmers. The farmers, in turn, need to co-operate by placing their orders for spare parts now, and to recondition their old machines preparatory to harvest.

It is realised that the replacement of animal horse-power on the farms by mechanical power has created the desire to mechanise the harvest machines also, but that does not eliminate the usefulness of the old type, ground-driven harvesting machines. Those machines can still do the work if the farmers cannot get modern power take-off equipment for this season to replace them. The view at the moment is that there will be enough old machines on the farms to handle the crops provided those machines are put in working condition soon enough. That largely rests with the farmers concerned.

Without being unduly pessimistic in outlook it should be realised that the demand for new tractors and harvesting machines cannot be fulfilled before harvest. The dollar and shipping shortages will limit importations, and man-power and material shortages govern the volume of local production of harvesting machinery. Farmers would be wise at this juncture to study alternative measures to solve their equipment problems. Claims from ex-servicemen continue to absorb the greatest proportion of the available stocks of farm equipment.

[Contributed by the Agricultural Division.

FAT LAMB INVESTIGATIONS

Rutherglen Research Station

By W. B. Miller, M.Agr.Sc., Senior Inspector of Agriculture, and N. C. Killeen, B.Agr.Sc., Manager

The utilization of pasture to best advantage requires attention and investigation to the same extent as pasture improvement itself. The object of this is to obtain the maximum net return per acre over a number of years consistent with the maintenance of the numbers and health of stock. The importance of quality of meat in both the export and local markets is generally appreciated, but quality should be considered in relation to the quantity produced.

On improved top-dressed pastures in districts enjoying a 20 to 30-inch annual rainfall, the production of export lambs is usually more profitable than wool-growing alone, and is now the predominant form of sheep-raising in Victoria. At the Rutherglen Research Station it has proved practicable to carry, for the period May to November, two large-framed ewes and their lambs per acre of improved pasture (including subterranean clover). Sufficient feed remains to carry the ewes and unsold lambs through from December to April. In addition, it has been possible, in some seasons, to conserve considerable quantities of pasture hay and silage.

Heavier stocking would have resulted in poorer fattening of lambs, less wool per ewe, and the necessity for heavy hand-feeding in some seasons, while lighter stocking would have permitted larger lambs, a minimum of reject or carry-over lambs, but a smaller total production of meat and wool.

Decisions as to intensity of stocking must always remain, to a great extent, questions of judgment. The choice of the most suitable sheep to employ is also a difficult one, for all breeds of ewes and rams have their advantages, at least in certain districts and for specific conditions. Also the most desirable types are not always available at a reasonable price, and market conditions continually fluctuate.

INVESTIGATIONS AT RUTHERGLEN

With the increase in the numbers of fat lambs produced in the Rutherglen district, typical of the general expansion of the industry in Victoria, information was required as to which of the various types of ewes available would be most suitable as fat-lamb mothers, and to which breed of ram they should be mated. With the object of providing accurate information, a series of experiments has been undertaken at the Rutherglen Research Station. They were commenced in 1932, and progress results were published in a report in this Journal in October, 1939. In these trials, half-bred Romney Marsh–Merino ewes were compared with large-framed comeback ewes when mated to Border Leicester and Southdown rams to produce export fat lambs.

The results favoured the half-bred ewes which produced bigger lambs of better quality than did the comebacks whose slightly greater wool return at September, 1949 price levels was insufficient to offset the lower return from their lambs.

In 1940, a further series of experiments was commenced using Border-Leicester x Merino ewes and a line of smaller, fine-woolled comebacks.

In addition, lines of typical ewes of the following classes were purchased as weaners and compared as fat-lamb mothers and wool-growers, numbering 100 in each group :—

Border Leicester–Merino ;
Romney Marsh–Merino ;
Corriedale–Merino ;
Polwarth.

The former two classes were chosen as representative of the heavier types of half-bred ewes in common use, and the latter as representative of two types of finer-woolled ewes. The Polwarth weaners were bred in the Hamilton district and the other types in the Southern Riverina.

Results of Ewe Comparisons

The first of these two experiments, conducted in 1940 and 1941, confirmed the results of the earlier trials, with a slightly greater margin of difference on this occasion between the half-bred ewes and the lighter comebacks.

The second experiment, carried out over the four years, 1941–44, yielded much detailed information, which is summarised in Table 1.

The 1949–50 schedule of prices for export lambs sold on a "weight and grade" basis was used to calculate carcass values, namely :—

Quality Grade.	Range of Carcass Weights lb.				
	20–28	29–36	37–42	43–50	51–56
	D's.	2's.	8's.	4's.	T's.
	Pence per lb.				
Down ..	11·78	11·24	11·01	10·31	7·67
First ..	11·16	10·62	10·39	9·69	7·67
Second ..	10·93	9·85	9·07	8·22	..
Third ..	9·54	8·92	8·92	8·92	..

Rams used to produce the lambs referred to in Table 1 were Border Leicester and Southdown, 1941–2–3, and Dorset Horn, 1944.

The general conclusions drawn from these results are :—

(*a*) Border Leicester–Merino ewes produced heavier lambs, of better quality, and more valuable than the other three ewe classes ;

(*b*) There was no significant difference between lambs produced by Romney-Merino ewes and Corriedale-Merino ewes ;

(*c*) Lambs from Polwarth ewes did not compare favorably with those from the other breeds.

TABLE 1.—RESULTS OF COMPARISON USING FOUR TYPES OF EWE.

(Average 4 years, 1941–44.)

Ewe Type.	Border Leicester x Merino.	Romney Marsh x Merino.	Corriedale x Merino.	Polwarth.
	lb.	lb.	lb.	lb.
Lambs, average frozen weight	33·6	31·6	30·7	28·8
Percentage 1st quality	61	50	50	41
	s. d.	*s. d.*	*s. d.*	*s. d.*
Average value carcase (1949)	28 6	26 6¾	26 0¼	24 4
Average skin value (1949)	7 6	7 3	7 3	7 0
Total lamb value	36 0	33 9¾	33 3¼	31 4
	lb.	lb.	lb.	lb.
Average wool clip (4 years)	8·4	8·6	8·4	8·1

NOTE.—The above period included two poor seasons, one the 1944 drought year. In the three years 1941-43 the experiment was duplicated, using both Border Leicester and Southdown rams. In 1944 Dorset Horn rams only were used.

Southdown Cross lambs from Border Leicester–Merino ewes.

As can be seen from the table, the weight of wool shorn from each type of ewe was very similar. Differences in the return from wool production came mainly from differences in values per lb. The variations in wool price during and since the war are discussed fully in a later section.

SUMMARY OF COMBINED EWE AND SIRE TRIALS IN PROGRESS AT RUTHERGLEN.

Group.	Ewe Breed.	Description.	Ram Breed to which Mated.
C. ..	Border Leicester–Merino Corriedale–Merino Dorset Horn–Merino	ex Walpeup, 1942 drop	Southdown
D. ..	Border Leicester–Merino Corriedale–Merino Romney–Merino	ex Coonamble, 1942 drop	Southdown
E. ..	Border Leicester–Merino Corriedale–Merino Dorset Horn–Merino	ex Walpeup, 1943 drop	Southdown
F. ..	Border Leicester–Merino Romney–Merino	ex Coonamble, 1943 drop	Southdown and Dorset Horn

Further Experiments

The scope of the investigations has been extended by a joint experiment* undertaken by the New South Wales and Victorian Departments of Agriculture in 1941, when a line of 2,100 Merino ewes was mated in three equal groups to Border Leicester, Romney Marsh, and Corriedale rams at Coonamble in north-western New South Wales. When eighteen months old the resultant half-bred ewes were equally divided and forwarded to the Temora Experiment Farm in New South Wales and the Rutherglen Research Station for comparison as fat-lamb mothers, when mated with Southdown and Dorset Horn rams. At the same time, a parallel experiment was commenced by the Victorian Department of Agriculture using Border Leicester, Corriedale, and Dorset Horn rams, and mating them to large-framed Merino ewes at the Mallee Research Station, Walpeup, the resultant ewes being taken to Rutherglen also.

The 1942 ewes were first mated to lamb in 1944, and are still under trial. In these trials it can be seen that comparisons are obtained from :—

(1) Ewes of different breeding bred under identical conditions ;

(2) Ewes of similar breeding raised under widely different conditions.

So far, results have been obtained from these ewes over a period of five years, and the experiment has another year to run before completion. The findings to date agree broadly with those of the earlier experiments. A summary of the results obtained over five years from the Coonamble and Walpeup ewes shown is in Table 2.

As in the previous experiment, the best lambs have been produced from the Border Leicester cross ewes, with little difference between those produced by the Romney and Corriedale cross ewes. The new cross introduced, the Dorset Horn Merino, is an excellent fat-lamb mother, and, as can be seen from the table, produced lambs which

* This trial was sponsored by the Australian Wheat Board.

TABLE 2.—RESULTS FROM COMPARISON OF HALF-BRED EWES FROM COONAMBLE AND WALPEUP.

(Five years average, 1944-1948.)

Coonamble Ewes.	Carcass Valuation on 1949 Export Schedule.		
	Border Leicester x Merino.	Corriedale x Merino.	Romney x Merino.
	lb.	lb.	lb.
Lambs average frozen weight	33·9	29·6	30·3
Percentage Down and 1st quality, average 5 years ..	89·1	70·0	72·6
*Percentage Down quality, average 3 years	49·9	28·3	41·3
	s. d.	s. d.	s. d.
Value carcass, average 5 years	30 7	26 1	26 10
Average value skin	7 6	7 6	7 3
Total lamb value	38 1	33 7	34 1
	lb.	lb.	lb.
Wool clip (average 6 years)	7·8	7·7	7·5

Walpeup Ewes.	Carcass Valuation on 1949 Export Schedule.		
	Border Leicester x Merino	Corriedale x Merino.	Dorset Horn x Merino.
	lb.	lb.	lb.
Lambs average frozen weight	35·8	31·4	36·2
Percentage Down and 1st quality, average 5 years ..	88 1	72 6	84 2
*Percentage Down quality, average 3 years	57 9	35 8	54 9
	s. d.	s. d.	s. d.
Value carcass, average 5 years	31 5	27 5	31 8
Average value skin	7 6	7 3	7 6
Total lamb value	38 11	34 8	39 2
	lb.	lb.	lb.
Wool clip (average 6 years)	8·25	8·62	7·21

* There were no Down grades in 1944-45. All the lambs in these trials were sired by Southdown rams.

were the equal of those from the Border Leicester cross ewes. However, they cut a light fleece of comparatively low value and are less remunerative than the other crosses.

Wool Price Variation

Obviously, when comparing economic returns from breeds of ewes, both lamb and wool produced must be considered. The *relative* values of the lambs produced from the various breeds of ewes have remained stable over the years, although there has been an all-round increase following the higher prices received for lambs since the end of the war.

On the other hand, the relative values of the wool produced has been very unstable since 1946 due to the differential price rises in the wools from the various ewe crosses, particularly between the Border Leicester and Corriedale cross ewes. Table 3 shows the average price per lb. paid for fleece wool of the various crosses during the past four years, obtained by reference to the standard "bins" into which the wool was classed and sales at the times shown.

The average quality counts of the wool shorn from the ewe types under consideration have been Border Leicester x Merino, 56–58; Corriedale x Merino, 58–60; and the Romney x Merino and Dorset Horn x Merino about mid-way between these two. The prices illustrated in the table reflect this to a certain extent. Recently Romney cross wool values have been higher than Dorset Horn and Border cross wool, and Corriedale x Merino wool has been 5d.–6d. higher, reaching a maximum of 9d. in May, 1947. The extent of this divergence in price of the wools from the various breeds determines which will give the highest financial return

when both wool and lamb returns are considered. As a basis of comparison between the breeds an arbitrary flock unit of 100 ewes has been chosen, which can be considered to produce 100 fleeces and 80 lambs (lambing percentage for each breed being similar). The return to be expected from flocks of this size of each of the various breeds is shown in Table 4 using 1949 carcass values and (*a*) 1947 (May), and (*b*) 1949 (average March–June) wool values.

TABLE 3.—WOOL PRICES VARIATION, 1945–49.

—		1945.	1946.	1947 (May).	1947 (November).	1948 (November).	1949 (Average (March–June).
Border Leicester x Merino	Ex Coonamble	16¼	29½	31¾	32¼	60¾	54¼
Corriedale x Merino	Ex Coonamble	15¾	30¼	41¼	37	64½	61
Romney x Merino ..	Ex Coonamble	15¾	28¾	36¼	34	63½	60
Border Leicester x Merino	Ex Walpeup	16½	29¾	32½	31¾	61½	57¾
Corriedale x Merino	Ex Walpeup	14¼	30¼	40½	36¾	65	62¾
Dorset Horn x Merino	Ex Walpeup	15	29¼	38½	33½	61	59

TABLE 4.—GROSS RETURNS FROM FLOCK OF 100 EWES WITH 80 PER CENT. LAMBS.

(*a*) 1949 *Carcass Values* (*May* 1947 *Wool Values*).

Breed.	Return from 100 Fleeces.	Return from 80 Lambs (Carcass + Skin).	Total Return.
	£ s. d.	£ s. d.	£ s. d.
Coonamble Ewes—			
Border Leicester x Merino	100 6 1	152 5 0	252 11 1
Corriedale x Merino	123 18 8	134 3 4	258 2 0
Romney x Merino	108 6 11	136 5 0	244 11 11
Walpeup Ewes—			
Border Leicester x Merino	103 16 10	155 10 0	259 6 10
Corriedale x Merino	135 7 6	138 10 0	273 17 6
Dorset Horn x Merino	106 0 6	156 13 4	262 13 10

(*b*) 1949 *Carcass Values*. 1949 *Wool Values* (*Average March–June*).

Breed.	Return from (100 Fleeces.	Return from 80 Lambs (Carcass + Skin).	Total Return.
	£ s. d.	£ s. d.	£ s. d.
Coonamble Ewes—			
Border Leicester x Merino	165 0 10	152 5 0	317 5 10
Corriedale x Merino	179 7 6	134 3 4	313 10 10
Romney x Merino	173 1 8	136 5 0	309 6 8
Walpeup Ewes—			
Border Leicester x Merino	183 18 11	155 10 0	339 8 11
Corriedale x Merino	202 3 10	138 10 0	340 13 10
Dorset Horn x Merino	160 0 2	156 13 4	316 13 6

An attractive pen of Leicester-cross fat lambs from the Research Station. Average frozen weight 38·8 lb.

Table 4 shows that, under the wool prices ruling in May, 1947, the Corriedale x Merino ewes gave a higher return than Border Leicester x Merino ewes, but, using 1949 prices, the difference is small.

On the results obtained, the experiments show that, unless the price margin between Corriedale x Merino and Border Leicester x Merino wools is at least 7d. per lb., the latter type of ewe is the most profitable when lamb prices are approximately as at present.

A study of the various tables showing weight of wool shorn and the price received per lb. will show that the Dorset Horn x Merino ewes compare unfavorably in regard to quantity shorn, but the quality, as illustrated by the price per lb., is equal to that of either Border Leicester x Merino or Romney x Merino ewes.

Summary of Ewe Trials

General conclusions, therefore, are that, of the types compared, the Border Leicester x Merino ewes were superior for fat lamb production in this district, but under existing price levels for wool and meat, Corriedale x Merino ewes were equally remunerative and superior to both the Romney Marsh and Dorset Horn cross ewes.

The Dorset Horn-Merino cross, although it can produce good lambs, compares unfavourably with the crosses previously mentioned, when its low wool return is taken into consideration.

Results of Ram Comparisons

Comparison of sires is far more complex than that of ewe mothers, due to the wide difference in the breeds used and the far greater influence of seasonal conditions. Most of the comparisons at Rutherglen have been between Border Leicester and Southdown rams, these being the two breeds most favoured in the Rutherglen district.

The Border Leicester ram has, over a period of years, consistently produced heavier lambs than has the Southdown, but the Southdown cross lambs have been of consistently higher quality, and much less affected by adverse feed conditions than the Border Leicesters. The Southdown is capable of producing ideal export carcasses and the premium of ½d. per lb. at present being paid on "Down" carcasses should encourage its use.

Over 8 years, Border Leicester-cross lambs (37.1 lb.) have dressed 2.5 lb. heavier than Southdown lambs (34.6 lb.), from half-bred

High-quality Southdown-cross lambs from the Station. Average weight 36.7 lb.

(continued on page 494.)

ASSOCIATION HERD TEST

Report for Year 1948-49

By C. J. Bradbury, B.Agr.Sc., Supervisor of Herd Testing.

THE keenness of the Victorian dairy farmer in herd recording is clearly shown by the fact that, in this year's test, 127 units comprising approximately 100,000 cows, were in operation compared with 25 units in 1942, when approximately 23,000 cows were tested.

Beauty, leading cow in this year's test, is owned by Mr. W. E. Dyke, Dumbalk No. 1 Association. This mature cow produced 918 lb. butterfat.

To foster this keenness and provide greater stability and recognition to Association Herd Testing, the Department of Agriculture has set up a central office system of recording. Here, the production returns will be analysed and tabulated to obtain the greatest benefit from the bulk of herd-testing figures. Returns from some 35 units are at present being handled by this office.

The Department has also made provision for the appointment of seven field officers to be known as District Herd Test Organizers. Their job will be to maintain as far as possible continuous and efficient testing in each unit in their areas. Four of these officers have already been appointed and are stationed at Benalla, Warragul, Rochester, and Colac, while the remainder will be stationed at Leongatha, Sale, and Warrnambool.

Notwithstanding such adverse conditions as semi-drought throughout the Western District, caterpillar plagues in parts of Gippsland, and a few isolated locust infestations in the North-east, the 98,208 cows that completed the test averaged 253 lb. butterfat which, in the circumstances, must be regarded as satisfactory.

LEADING ASSOCIATIONS

The 338 lb. butterfat average for 1,111 cows gives pride of place to the Rochester West Association, while Stanhope, with an average of 312 lb. butterfat for 968 cows, gained second position. Katandra West and Tongala No. 1 were two other Goulburn Valley units with averages greater than 300 lb. butterfat.

Dumbalk North No. 1 with an average of 305 lb. fat for 1,008 cows leads the Gippsland units, and Camperdown with a 301 lb. average for 792 cows takes first place among Western District Units.

Merrigum No. 1, Tongala No. 2, Swan Hill, Cohuna No. 1, Merrigum No. 2, Leitchville No. 2, Rochester East, Undera, Pyramid-Calivil No. 1 and Leitchville No. 1 were other Goulburn Valley units to average over 275 lb. fat.

Toora-Welshpool, Yinnar, Leongatha Nos. 1 and 2, Warragul No. 1, Dumbalk No. 1, Kongwak and Korumburra Nos. 1 and 3 were other Gippsland units to average over 275 lb.

Mr. R. T. Harrison's mature cow, Champion, yielded 724 lb. butterfat. She is in the Dumbalk No. 1 Association.

In the Western District, Winchelsea No. 1 averaged 283 lb. butterfat, while Swanpool No. 1 with an average of 291 lb. leads in the North-eastern District from Tallangatta.

OUTSTANDING HERDS

The results this year include no less than 752 herds with an average of 300 lb. butterfat or better, and of this number 148 herds exceeded a 350 lb. average. Thirty-four herds had averages of 400 lb. or better and include the two leading herds of Mr. H. McLean and Mr. R. J. Connor each with averages exceeding 470 lb. butterfat.

Mr. H. McLean's eighteen cows in Leongatha Association comprise the leading herd in this year's report with an average of 502 lb. butterfat while the ten cows of Mr. R. J. Connor, Millawa, gained second place with an average yield of 475 lb.

Mr. P. A. Freestone of North Murchison No. 1 and Mr. F. W. Fulford of Bairnsdale No. 2, each with fourteen cows, were also prominent in the small herd section.

HERDS OF 20–39 COWS

In the 20 to 39-cow class, 23 herds averaged over 400 lb. butterfat. The highest yield is credited to Mr. P. Taylor, Rochester - West, whose herd of 34 cows averaged 451 lb. Leongatha No. 1 is represented by Mr. K. McLean's 21 cows with an average of 447 lb.

The herds of Mr. E. Jeffries of Kongwak and H. Burgman of Katandra West with averages of 445 and 444 lb. butterfat are also deserving of praise in this section. Other herds in this group exceeding the 420 lb. average are owned by Messrs. H. W. Wood of Winchelsea, F. J. Dinneen, Toora–Welshpool, R. J. Hansford, Traralgon, No. 2, T. A. Dickie, Katandra West, and Mrs. B. Malone of Winchelsea.

HERDS 40–59 COWS

The 40 to 59-cow section is led by the Rochester West representative Mr. C. W. Smith with an average of 443 lb. for his 56 cows. This dairy farmer is followed by Mr. A. Walker, Yinnar, whose herd of 45 cows averaged 430 lb. butterfat. Other leading herds in the 40 to 59-cow section are owned by Mr. J. McNicol, Tongala No. 2, Messrs. Harrison Bros., Korumburra No. 4, Mr. J. S. Bullingham, Tongala No. 1., Mrs. M. A. Park, Tallangatta No. 1, and Mr. J. A. Warnock, Swanpool No. 1. Each of these herds had averages exceeding 400 lb. butterfat.

HERDS 60–79 COWS

This section includes 26 herds with averages of 320 lb. or better, and of this number twelve exceeded 350 lb.

Goldie 2nd, owned by Mr. L. J. Affleck, Traralgon No. 1 Association, gave a four-year-old yield of 654 lb. butterfat.

One of this year's top producers, Mottley, gave a mature yield of 706 lb. butterfat. This cow represents the estate of W. Connihan in Bairnsdale No. 1 Association.

Messrs. Northey and Co., Bethanga (66 cows) and F. J. Olden of Korumburra No. 2 (61 cows) are the leaders in this section. Each of these owners' herds returned the excellent average of 383 lb. butterfat. They are followed by the 378 lb. average of Mr. G. Millard's herd from Kongwak while the 71 cows owned by Messrs. D. and G. Dodd, Dumbalk North No. 1 averaged 370 lb.

The herds of Mr. L. J. Affleck, Traralgon No. 1, Messrs. R. Farragher and Son, Woodford No. 1, Messrs. W. Dyke, Dumbalk No. 1, and G. R. Jones of Warragul No. 1 each returned averages exceeding 360 lb. Herds with averages greater than 350 lb. in this section were owned by Messrs. R. H. and J. L. Trease, Dumbalk North No. 1, Messrs. W. J. Miles, Bass No. 1, N. McKimmie, Upper Murray No. 2, and J. A. McKinnon and Son, Port Campbell No. 1.

HERDS OF 80 COWS OR MORE

In this section, 22 herds averaged over 250 lb. butterfat, including nine with averages exceeding 300 lb. The leading herd of 80 cows, owned by Mr. G. Harrison, Dumbalk North No. 1 produced the high average of 368 lb. The herds of Mr. R. T. Harrison, Dumbalk No. 1, and Mrs. A. Crosthwaite, Kiewa Valley No. 2, averaged 357 and 354 lb. respectively, while Messrs. A. J. Menzies, 103 cows, E. W. York, 80 cows, Meadowcroft Bros., 80 cows, and K. F. Zegelin, 112 cows, had herd averages exceeding 320 lb. butterfat. With 154 cows averaging 284 lb. fat, the No. 3 herd of Messrs. J. Moore and Co., Yarram, is worthy of notice. In last year's test this herd averaged 338 lb. butterfat.

27,000 COWS EXCEEDED 300 POUNDS BUTTERFAT LEVEL

Of the 27,187 cows yielding more than 300 lb. butterfat, no less than 5,168 cows yielded over 400 lb. Included in this number were 555 cows with productions of 500 lb. and 57 with yields exceeding 600 lb. Seven mature cows produced more than 700 lb. butterfat.

Beauty, the leading cow, is owned by Mr. W. E. Dyke of Dumbalk, No. 1; her yield was 11,823 lb. milk and 918 lb. butterfat.

Glenloth Mavis was in second place with a yield of 857 lb. butterfat. It will be remembered that this cow, owned by Mr. M. Drane of Traralgon No. 3, was the leading four-year-old last year.

The remaining five mature cows with yields over 700 lb. were Champion, Beryl, Bonnie, Mottley, and Ellinure Nola's Fancy, owned respectively by Messrs R. T. Harrison, Dumbalk No. 1, H. Kelly, Korumburra No. 4, L. S. and A. L. Hunt, Merrigum No.2.

Scarlett, from Mr. F. J. Dineen's herd, Toora–Welshpool Association, produced 678 lb. butterfat.

Mr. O. S. Martin's Fleck is in the Traralgon No. 3 Association. With 600 lb. butterfat, Fleck is among the year's high producers.

The estate of W. Connihan, Bairnsdale No. 4, and Messrs. J. A. McKinnon and Sons of Timboon No. 1.

There were 48 additional mature cows that yielded over 600 lb. fat and these include Smokey, Ingolston Superior, Mary Lou, and Pet owned by Messrs. North and Speeding, Leitchville No. 1, T. Gilmour and Son, Pyramid–Calivil No. 2, J. S. Bullingham, Tongala No. 1, and N. L. Pratt, Warragul No. 2, respectively. Each cow gave a yield exceeding 680 lb. butterfat.

THE FOUR-YEAR-OLDS.

The leading twenty four-year-olds all exceeded 530 lb. butterfat and included cows with yields of over 600 lb.

Leading in this section was Rita, owned by Messrs. H. E. Furphy and Son of Dumbalk No. 2, with a yield of 9,681 lb. milk producing 670 lb. of fat. She is followed by the 654 lb. fat yield of Goldie 2nd owned by Mr. L. J. Affleck of Traralgon No. 1.

Messrs. L. S. and A. L. Hunt's Nancy from Merrigum No. 2 is another four-year-old to exceed 600 lb. butterfat, while Cookie, Stumpy, and Netta owned by Messrs. C. W. Smith, Rochester West, F. G. Howell, Leongatha No. 2 and P. A. Freestone, North Murchison No. 1, respectively, each produced over 560 lb. of butterfat.

THE THREE-YEAR-OLDS

Margaret, with a milk production of 11,313 lb. yielding 642 lb. butterfat, led this section for her owner, Mr. C. W. Smith of Rochester West.

Fom Leongatha No. 1, Mr. H. McLean's Denbigh Beatrice, with 608 lb. butterfat was placed second in this age section, while Melba and Linda owned by Mrs. B. McIlroy, Moyhu, and Mr. P. Taylor, Rochester West, respectively, were two other three-year-olds to exceed 590 lb. fat.

Other three-year-olds yielding over 550 lb. were Fairy 5th, Glenda, and Duke's Do-Do, owned by Messrs. A. Walker, Yinnar, P. Taylor, Rochester West, and E. Jeffries, Kongwak, respectively.

THE TWO-YEAR-OLDS

The top twenty two-year-olds this year exceeded 460 lb. butter fat and included twelve cows with yields of 500 lb. or better.

With 612 lb. butterfat from 8,713 of milk, Darky, owned by Mr. W. Miles of Pyramid–Calivil No. 2, takes pride of place among the two-year-olds.

Mr. J. S. Bullingham of Tongala No. 1, took second and third place with his two representatives Mary and Eva 3rd. These two heifers yielded 555 and 552 lb. butterfat respectively.

Lucy, Myrtle, and Beauty, owned by Messrs. P. Taylor, Rochester West, W. E. Dyke, Dumbalk No. 1, and H. Oliver, Rochester West, respectively were other two-year-olds to exceed 530 lb. butterfat.

Rose 3, Kiewa Valley No. 2 Association, is owned by Mrs. A. C. Crosthwaite. Rose produced 606 lb. butterfat.

(continued on page 521.)

LIVE STOCK NOTES

Compiled by A. C. T. Hewitt, M.Agr.Sc.,
Live Stock Science Officer

PRODUCTION REGISTER OF RED POLL BULLS

THERE are 61 bulls in the production register of the Red Poll Cattle Breeders' Association of Australia and, as with all sire surveys, it has been found that about one-third of the bulls have raised, one-third have maintained, and the remainder have lowered production.

A bull to be placed on the register must have a minimum of five daughters tested under Government official herd test and, for a bull index to be shown, it is necessary for the bull to have a minimum of five tested daughters from tested dams. A bull index is shown for 44 of the 61 bulls on the production register.

Burnwood Masterpiece, senior herd sire, State Research Farm, Werribee.

The "Victoria" Stud of the Department of Agriculture has played a prominent part in the development of the Red Poll breed throughout Australia, and 26 of the 61 bulls in the register have had their daughters tested at the State Research Farm, Werribee. Nine of the bulls were bred in the "Victoria" Stud, but had their daughters tested elsewhere.

In the latest review of the register, which includes all daughters tested to 30th June, 1948, figures for five of the sires used in the "Victoria" Stud are shown. The leading sire at Werribee for many years was Woodburn Peter Pan, whose 85 daughters averaged 399 lb. of butterfat. This bull's production index was 407 lb. His daughters from tested dams produced an average of 6 lb. more than their mothers. Chandpara Valentine, another sire used some years ago with Woodburn Peter Pan, had 25 daughters with an average of 374 lb. butterfat. Those from tested dams averaged 2 lb. more than their mothers.

The present senior herd sire at Werribee, Burnwood Masterpiece, has 46 daughters averaging 415 lb. of butterfat or 12 lb. more than their dams. It takes a number of years to progeny-test a sire and when the production register was compiled, the new herd sire Naranghi Master had only four tested daughters which had produced particularly well. Another sire in use in the stud, Victoria Petain, by Burnwood Masterpiece, has eight tested daughters which have produced 27 lb. less butterfat than their dams.

The bull Victoria Generator B has raised the production of his daughters 40 lb. of butterfat above their dams. This bull is a half-brother to Victoria Electricity, the world's highest-producing Red Poll cow. Electricity produced 777 lb. of butterfat recently.

Victoria Generator B was used in Mr. F. T. Butcher's herd at Swan Hill, but like so many good bulls, reached the slaughter yards before his real value was known.

[A.C.T.H.]

MEAT IMPORTS TO GREAT BRITAIN

Meat is the foodstuff in most urgent demand by the people of Great Britain, and the following table, showing how imports from all countries other than New Zealand have declined in the ten years since 1938, should be of interest.

Country of Origin.	Imports of Meat into Great Britain.	
	1938.	1948.
	Tons.	Tons.
Australia	244,430	190,938
New Zealand	274,437	365,167
Denmark	173,815	36,563
Argentina	482,228	309,662
Other Countries	363,247	225,092
Total	1,538,157	1,127,422

[A.C.T.H.]

PRE-HEATING OF EGGS FOR INCUBATION

When investigating the cause of poor hatches, it is the usual practice to commence with the breeding stock. The condition of the birds and the presence of external parasites should be investigated. Feeding and housing should be carefully checked. Under-mating, over-mating, or the presence of one or more aggressive male birds often cause infertility but many apparently normal chicks often die in the shell, when the breeding stock are healthy and the feeding, housing and management are satisfactory.

Thirty years ago, when hatching was carried out in fire-heated incubators, breeders were obliged to accept 40 to 50 per cent. hatches of all eggs placed in incubators, but with the advent of the early electric cabinet machines the percentage was increased to 60 per cent., allowing for 20 per cent. infertile and 20 per cent. dead-in-shell.

With modern improved techniques, the percentage hatched of all eggs placed in the machines has now increased to approximately 70 per cent., allowing 20 per cent. for infertile eggs and 10 per cent. for dead-in-shell.

Experienced hatcherymen know that the temperature drops when cold eggs are placed in the incubator. The time taken to regain normal temperature depends on the number of eggs placed in the machine and the temperature when the operation is carried out. During the months of July and August when the weather is cold, the drop in temperature can be very pronounced. To overcome this loss of warmth a modern practice is to pre-heat the eggs before placing them in the incubators with other eggs.

Greatly improved results have been obtained on a large commercial poultry farm since the introduction of this practice.

The system is of great value when eggs are placed in the machine at the time when other eggs are close on hatching, and the value is increased when eggs are placed in the incubator more than once a week.

Eggs are heated in a separate machine of smaller capacity for approximately 12 hours or until they are completely heated to the required temperature. The eggs are placed in the small incubator at 7 o'clock in the evening and transferred to the large incubators the following morning.

On one farm pre-heating increased the hatchability by 5 to 7 per cent.

[M. D. HALL, Poultry Expert.]

SELECTING PIGS

Whether it is possible by skill or by luck to select good breeding pigs when they are very young, it is certain that the best time to select them is when they are the size at which their progeny will be sold for slaughter.

When a pig is at baconer weight and condition, it can be judged best for its potential bacon-producing qualities. In the case of a boar, even at bacon weight, some allowance should be made for masculine characteristics such as heavy shoulders and perhaps a few wrinkles.

Form

It is only natural to be attracted by the symmetrical form of a pig even though visits to meat-works remind us that the "symmetry" is mainly due to an inch or two of fat beneath the skin. One needs an X-ray eye or at least some experience of carcass appraisal to visualize the more permanent bones and muscles that are the foundation for that fat.

Teats

The pleasing form of a pig tends to distract attention from the more utilitarian features. Take the teats for example. When her youthful porcine beauty is forgotten, a brood sow will be judged by the number and size of the pigs she rears and this will depend on her udder and teats. A defect in bodily form can be overlooked, but faulty udder or teats in a sow will be reflected in every litter she rears.

Twelve or more teats are desirable, but more important than number is development and spacing. Plenty of space between teats means plenty of room for the milk-secreting mammary glands.

The Sire

One is sometimes tempted to overlook a teat deficiency in an otherwise good boar, but that is risky because there is some inheritance of teat characteristics from sire to daughter.

[L. A. Downey, H.D.A., Pig Expert.]

GOATS' MILK RECORDED AT ROYAL SHOW

This year for the first time goats had their milk production recorded at the Melbourne Royal Show. Prizes were given for the does producing most milk during the 24-hour period commencing 6 p.m. on the 23rd September, to 6 p.m. the next day.

The does were naturally upset by the transfer to the showgrounds and the delayed milking on judging day, the 22nd September. Five does were entered in the milk production class and their yields varied from 12 lb. 11 oz. to 5 lb. 9½ oz. and the butterfat tests of the samples varied from 8·6 to 3·2 per cent. The samples were analysed at the State laboratories for the solids-not-fat, which include protein, sugar, and ash. The results are set out in the table on this page.

BEEKEEPING

Bees emerging from the winter in poor condition will have to be fed to bring them up to strength in preparation for the honey flow.

Milk Production Class for Goats, Melbourne Royal Show, 1949.

Name of Goat.	Owner.	Milk Yield.		Analysis.				
				Moisture.	Ash.	Protein.	Fat.	Sugar.
			lb. oz.	%	%	%	%	%
Kelvin Brae Josie ..	Mr. and Mrs. M. Mackay, Glenroy ..	Morning ..	6 15	85·9	0·8	4·0	4·4	5·7
		Evening ..	5 12	84·8	0·8	3·9	5·2	6·1
		Total ..	12 11					
Carramar Wren ..	Mr. and Mrs. M. Mackay, Glenroy ..	Morning ..	5 9½	87·8	0·9	4·0	3·2	5·0
		Evening ..	4 10½	86·6	1·0	3·8	4·3	5·3
		Total ..	10 4					
Warrawee Queenie	Mr. and Mrs. O. Grayson, Heidelberg ..	Morning ..	4 13½	82·1	0·9	5·1	7·5	5·3
		Evening ..	4 7½	81·4	0·9	4·4	8·6	5·6
		Total ..	9 5					
Rockalpine Rosetta	Mr. and Mrs. O. Grayson, Heidelberg ..	Morning ..	4 3	86·5	0·8	3·7	4·6	5·2
		Evening ..	3 10½	85·8	0·8	3·6	4·6	6·0
		Total ..	7 13½					
Tiltargara Maxine..	Dr. C. S. Sandy, Essendon	Morning ..	3 0	83·9	0·9	4·9	5·4	5·8
		Evening ..	2 9½	83·5	0·9	4·9	6·0	5·6
		Total ..	5 9½					

[A.C.T.H.]

In building a colony to production, it must be borne in mind that about six weeks elapse between egg-laying and the date that the new bee will enter the field as a worker, the first two weeks of its life being occupied as a nurse or house bee.

The first objective of the apiarist is to get the required number of bees into the weaker colonies and this can be carried out over a period of a week's good flying weather. This can be done by removing several frames of brood from very strong colonies—making sure that you do not get the queen—and shaking off the bees in front of a weak colony. The young bees will crawl in and join the weak colony, and the fielders will fly home to their mother hive. When this is done several times, frames of brood can be added to the weak colony, without fear of chilling.

It is not advisable to add brood to weak colonies, without first making sure that sufficient bees are present to cover it. If colonies are fed at evening, and by making sure that robbing is not encouraged, hives may be changed from one location to another by placing a weak colony upon the stand of a strong one, and vice versa. This procedure will remove a great many of the field bees and minimize swarming from the stronger colonies.

If the bees show any inclination to fight, smoke them freely. It may also be advisable to cage the queen in the weaker colony.

[W. A. Collins, Senior Apiary Inspector.]

FAT LAMB INVESTIGATIONS—*(continued from page 486).*

ewes. The "Down" grade has applied for only three years, the results of which are shown in Table 5.

Table 5.—Comparison of Export Lambs Produced from Half-bred Ewes by Border Leicester and Southdown Rams.

(Average—three years.)

Sire.	Average Weight. (Frozen)	Lambs 1st Quality.	Carcass Value.	Skin Value.	Total Value.
	lb.	%	s. d.	s. d.	s. d.
Border Leicester	35·6	64	30 1	7 7	37 8
Southdown..	33·5	77	30 0	7 0	37 0

Note: Values as at September 1st, 1949.

The figures in the table comprise all the lambs produced. These were lifted together at the end of the season. Fifty-nine per cent. of the Southdown-cross lambs were graded as "Downs" and obtained the premium—this year $\frac{5}{8}$d. per lb.

Unless the Southdown lambs are good enough to have a big percentage of "Downs" they are not likely, in the Rutherglen district at least, to give as big a return as lambs sired by Border Leicester rams. They show to advantage more with half-bred ewes than comebacks, and on improved pastures. As carry-over lambs to be shorn they are inferior to the long-wool cross, but have the advantage of nearly always fattening sufficiently to be accepted for export, and, if early dropped, can be marketed in some years before prices fall to export parity.

Tests have also been conducted with the Dorset Horn and Suffolk rams on half-bred ewes. The Dorset Horn is particularly useful in getting early lambs, and, for mid-season use, is equal to the Border Leicester, which takes longer to mature. In a good season, the Border Leicester-cross lambs are as heavy, and in a poor year are more suitable to shear.

The Suffolk-cross produces large-framed, big lambs which mature at heavy weights, but which require a favourable season to finish satisfactorily.

The experiments have demonstrated the main characteristics of the several breeds, for application in the particular type of production planned for, and according to the class of ewes and pasturage available.

It will be noted that the comparative monetary returns from the various crosses change considerably with variations in relative prices for wool and meat, and the different grades of these products. However, the records of weights and grades of lamb carcasses and classes of wool can be used at any time by the application to them of any particular scale of values, so making the experiments of permanent value.

Report of the Judge, W. J. Tame, Field Officer, Soil Conservation Board.

The Upper Murray Region, as defined by the Central Planning Authority, includes all the Victorian catchment to the Murray River and tributaries from their headwaters as far downstream as Yarrawonga, with the exception of that part of the Omeo shire south of the Dividing Range. This year, the area covered by the competition was extended to include that part of the Omeo shire located in the catchment feeding ultimately to the Murray River. This area has a higher erosion hazard than most of the Upper Murray Region, due to differences in soil types, topography, and climate. The combination of these is such that the land does not readily recover from any serious maltreatment.

GRAZING is the main use to which land is put in the Upper Murray region, although extensive areas in the mountainous parts are retained as Crown lands, and timber and forest reserves. Sheep are grazed more or less generally over all the privately owned country, with wool production the principal objective. Cattle for beef production are also raised over extensive areas, particularly on the higher country.

Along the fertile river valleys a more diversified agriculture is practised—dairying, fat-lamb production, fattening of sheep and cattle, and growing of cereal and specialty crops. On the lower reaches at the western end of the catchment, extensive cultivation for winter cereal crops is common.

INCIDENCE OF EROSION

The principal types of erosion encountered in the region are sheet erosion and gully erosion which occur mainly on the higher grazing lands where climatic conditions do not favour ready or abundant growth. Elsewhere, some gullying has occurred on cultivated land and stream erosion is at times a major problem.

Looking at the region as a whole, however, it is apparent that most of the erosion occurs on grazing land, and can largely be attributed to overgrazing. The following comments based on observations made during the judging, apply principally to grazing lands.

It is true that much of the sheet erosion on this grazing country occurred during lean or " droughty " periods, and that many of the gullies were started by heavy rain following a dry period.

The farmer or grazier cannot prevent floods or droughts, but he can take precautions against them, and must indeed do so if he is to prosper and be a good soil conservationist.

The maintenance of pasture cover at all times adequate to protect the soil from the direct action of wind and rain, should be one of the first objectives of every grazier. Soil so protected retains, and may increase, its ability to absorb and hold the rain that falls on it. On the other hand, land sparsely covered with herbage tends to " skin over," and lose its ability to absorb rain. Productivity is thus reduced and the amount of water running off to gullies and streams is increased. On such poorly covered and " skinned over " grass land, the ploughing of level or contour furrows a few feet apart is a valuable mechanical aid in preventing further soil loss and encouraging re-establishment of ground cover. Some excellent examples of contour furrowing were inspected during the judging.

District farmers and their families attend field day on the property of Mr. W. H. Jarvis, winner of this year's competition.

FENCING AND SUB-DIVISION

On land fringing rough country, a rabbit-proof netting boundary fence is a necessity. On properties of large area and various slopes, it is advisable also to net some of the sub-divisional fences to satisfactorily control rabbits. It is unfortunate that, over the last few years, shortage of fencing materials has hindered the proper maintenance of existing fences, and largely prevented the erection of additional fencing.

It is well to consider soil types and slopes when contemplating additions and alterations to sub-divisions. Soil types vary with slope and aspect, and with these variations there is a corresponding variation in the ability of the soil to grow pasture and to respond to treatment. Steep slopes must necessarily remain under native pasture, moderate slopes can be improved by top-dressing and the introduction of subterranean clover, while the flatter country can be cultivated and sown to improved pasture species. It is obvious that the grazing value of such differing areas will vary greatly, and that production from them will largely be available at different times of the year.

To assist in the control of grazing, sub-division, as far as practicable, should separate the various types of country. The steeper country should be separated from the gentler slopes and where possible, the northern slopes separated from southern slopes. Further sub-division should then be according to the requirements of farm management. Smaller paddocks can generally give greater returns per acre than larger ones. Large paddocks cannot always be fed off evenly. Some areas are over-grazed, often to the extent that sheet erosion commences, while the grass on the other areas becomes rank and unpalatable, and is useless for grazing.

On a property closely sub-divided, any paddock can be treated according to grazing requirements. Paddocks can be closely or lightly grazed, closed for a seeding period or for the production of meadow hay, or cultivated and sown to improved species of grasses and clovers.

A major factor in any plan of subdivision is water supply. Landholders in the Upper Murray region are particularly fortunate in this regard, although the large number of good springs and permanent streams in the area could sometimes be used to better advantage. Springs, for example, are often damaged by stock. If they were fenced off and the water taken by pipe to a well-located trough, the farm would be better served and the springs improved in appearance and yield.

STOCK—RATES AND TYPES

The choice of particular breeds of cattle or sheep is one for individual taste and has small influence in a soil conservation plan. What is important, however, is whether sheep or cattle or both are kept, the rates at which they are grazed, and when they graze particular areas. The degree to which

the grazier is able to maintain an adequate ground cover and a balance of grasses and clovers in that cover, and at the same time make economic use of pasture growth, is greatly influenced by the type or types of stock carried.

Cattle can utilize bulky or "rough" feed to advantage but tend to graze selectively, and seldom give the maximum safe return per acre. On the other hand, the grazing of sheep often results in the pasture being grazed too heavily, often from the desire to avoid the development of "rough" feed which is not palatable to sheep.

Such close grazing can result in the elimination of the more desirable grasses, leaving an undesirable pasture mixture often dominated by clover. Nutritional diseases of sheep may then occur and "high-fertility weeds", such as barley grass and cape weed, can become a problem. There is an increasing conviction among graziers that only by combining sheep and cattle can pastures be so managed as to avoid the troubles mentioned, and at the same time provide the maximum safe return.

Rates of stocking that will give an adequate financial return and yet provide a reasonable margin of safety are hard to assess because of seasonal variations. In the area, however, the tendency has been to overstock rather than otherwise, principally because in the past the necessity to "carry over" a body of feed to protect land from erosion, has not been realized.

Evidence was apparent on some properties of overgrazing and consequent sheet erosion on sloping ground. The use of cattle only on such areas for a season or two would be of great assistance in restoring vegetative growth and re-building the surface soil.

Grazing management should provide that pastures on the steeper lands and country with a northern aspect and high erosion hazard, be allowed to make good growth before the end of the growing season, and thereafter should be so stocked that an adequate cover is maintained to protect the land from autumn storms. This country will then provide better winter and early spring feed when the lower country may be wet and cold.

SHADE AND SHELTER

Little attention had been paid by some competitors to planning sufficient shade and shelter, although on some farms ample shade trees had been left.

Pasture development on the contour-strip principle on the property of Mr. W. H. Jarvis. The hill in the foreground is too steep to safely cultivate a large area, so contour strips were worked up for sowing to improved species.

Sheep grazing on contour-furrowed pasture land in the Omeo district. The furrows have grassed over and the sward has thickened on this northern slope.

Shelter belts are of most benefit during the cold months of the year. Narrow windbreaks should be across the direction of the prevailing winds, or in the shape of an "L" or a "T." All shelter should be fenced off to allow development of growth from ground level upwards. When planting, the landholder would be well advised to choose trees with some fodder value.

Shade trees are not required in such numbers as were found on some properties. However, there should be sufficient shade provided in each paddock to allow the maximum number of stock that the paddock will be required to carry at any one time, to camp comfortably as one group within that shade.

The site of shade trees is important. It is not good practice for example to provide shade on the highest point of a paddock. Constant traffic to and from shade, feed and water, causes the formation of uphill and downhill stock tracks, and these can develop into gullies. Stock normally choose the highest available spot on which to camp, and it is desirable to discourage rather than encourage this habit. As shade is required in hot weather, a dry spot is not necessary and shade can well be provided on the lower slopes or flat ground. Where a hillside is used for shade or shelter, the shelter belts may be on approximate contour, thus avoiding the formation of up-and-down tracks outside the belt itself.

The use, as farm woodlots, of otherwise useless corners and portions of a farm with a high erosion hazard, has not received much attention in Victoria, and it is a feature to which property owners might give some consideration. The growing of trees for firewood, posts, and other commercial uses, is a profitable way of using those parts of the farm which are not well suited for grazing or cropping.

Where streams are permanent throughout the Upper Murray region, excellent use has been made of weeping and basket willows for the protection of stream banks. These trees, particularly the weeping willow, can be used for fodder in times of drought.

FODDER RESERVES AND PASTURE COVER

Seasonal conditions throughout the region had been favourable. Good early spring rains provided an abundant growth, and an early break in the autumn followed by further rains three to four weeks later, gave pastures a good start.

Despite the opportunity given by these favourable conditions, few entrants had built up a fodder reserve sufficient for the number of stock carried. While droughts as known in some parts of the State, do not occur in the Upper Murray region, the cold winters retard the growth, particularly in the higher country, and make hand feeding of stock a frequent necessity. Under such circumstances every stockowner should endeavour to provide sufficient stored fodder to meet the needs of his stock during a severe winter.

If attempts are made to carry stock over the winter without supplementary feeding, it is most likely that, unless rates are kept at an unprofitably low level, the grass cover will become so sparse as to afford no protection to the soil.

THE COMPETITION

Twenty entries were submitted from six of the eleven shires in the region. Prizes were offered by shire councils and an Agricultural and Pastoral Society for the best entry within each of four shires. In only one shire, Omeo, however, were sufficient entries received to permit the prize being awarded.

ENTRIES—UPPER MURRAY SOIL CONSERVATION COMPETITION—1948/49.

Name of Competitor.	Address.	Shire.
L. V. Brown ..	Tallangatta ..	Towong
W. S. Cheshire ..	Burrowye ..	Towong
A. Lawrence ..	Walwa ..	Towong
W. B. Lawrence ..	Walwa ..	Towong
W. H. Fleming ..	Tallangatta ..	Towong
D. H. Hallett ..	Omeo ..	Omeo
H. Nicholas ..	Benambra ..	Omeo
R. K. Love ..	Omeo ..	Omeo
J. W. Bales ..	Omeo ..	Omeo
O. H. Pendergast ..	Benambra ..	Omeo
C. M. Tice ..	Omeo ..	Omeo
W. F. Faithfull ..	Omeo ..	Omeo
R. Spencer ..	Benambra ..	Omeo
A. E. Hollonds ..	Benambra ..	Omeo
J. E. Hollonds ..	The Brothers	Omeo
Mrs. O. Hyland ..	Omeo ..	Omeo
W. H. Jarvis ..	The Brothers	Omeo
D. M. and J. K. Gibb	Bobinawarrah	Oxley
K. D. Watson ..	Wodonga ..	Oxley
J. Carmody ..	Nariel ..	Upper Murray

Willows are valuable for protecting stream banks, as shown on the property of Mr. J. Carmody, Nariel.

Gaunt reminders of the devastation caused by fire. In addition to the direct loss and suffering it causes, fire creates an erosion hazard of the first magnitude. Protection of the upper catchment areas from fire is essential to the permanence of our water storages.

AWARDS

The Hanslow cup for 1949 was awarded to Mr. W. H. Jarvis, The Brothers, Benambra. This competitor's property of 305 acres is devoted to the production of wool and beef, and supports nearly two full-grown sheep to the acre in addition to cattle in the proportion of one beast to thirty sheep.

Over two-thirds of the property has been sown to improved pasture, including very good stands of Phalaris tuberosa, perennial rye grass, and cocksfoot, together with subterranean clover. On another area of 80 acres, the native pasture has been top-dressed with superphosphate. The different grass varieties have been sown in different paddocks and, with the clover, provide excellently balanced pasture of good quality.

Subdivision has been well planned. The flat country carrying good pasture has been divided into small paddocks and provides the bulk of the grazing on the property. The hill country is separated from these paddocks and an effort is being made at pasture improvement on the contour pasture-strip principle. Contour lines were marked out on the hillside at approximately two-chain intervals, and half the area between

these lines was cultivated on the contour and sown to grass and clover. The area between the sown strips is controlled by contour furrowing.

A most interesting attempt has been made, in association with the Soil Conservation Board, to arrest the headward erosion of a large gully by a comprehensive planting of trees. The work is of an experimental nature, and several species of trees have been planted. Some replacements will be necessary, but information from the experiment should be of advantage to property owners with a similar problem.

The property of Mr. J. E. Hollonds, also of The Brothers, was the next best entry in the Omeo Shire, and this landholder gained the award made jointly by the Omeo Shire Council and the Omeo Agricultural and Pastoral Society. Although of small area, approximately 160 acres, every endeavour had been made to produce maximum returns while maintaining soil fertility and stability.

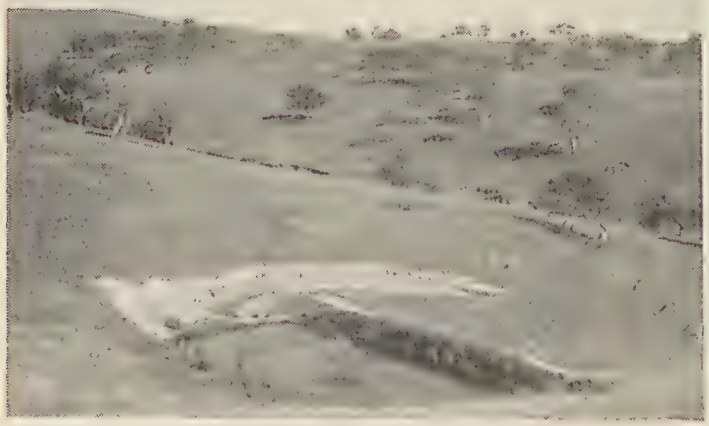
Mr. Hollonds has a stud of fine wool merinos on highly improved pasture consisting of perennial rye grass, cocksfoot and subterranean and white Dutch clovers. Fodder reserves and the use of natural water for stock and domestic supplies are a feature of the property. The erosion hazard, however, is not as high as on some other properties in the competition.

Mr. James Carmody exhibited a property of high standard. Pastures on the Nariel Creek flats have been developed to a high level of production, while the rising country has been allowed to remain in timber and provides good roughage and shelter for the cattle. The planting of willows along the scouring banks of the Nariel Creek has brought about complete stabilization of the banks. Use is made of a water-race from a small creek for domestic supplies.

The entry submitted by Messrs. D. M. and J. K. Gibb of Bobinawarrah demonstrated extensive use of contour furrowing on some country rather badly sheet-eroded. The furrows had been sown and the strike of subterranean clover was most encouraging. The improvements to pastures on the gentler slopes and their added capacity to produce, shows the advantage to be gained by such treatment. A timbered area has been preserved and supplies the farm's timber requirements for buildings and yards.

The property of Mr. K. D. Watson, "De Kerrileau," Wodonga, is bounded by the Kiewa and Murray Rivers. Some good work has been done on this farm by the diversion of water from scouring gullies, the filling of the gullies and sowing the reclaimed areas to pasture.

Mr. A. E. Hollonds, Benambra, only recently acquired the property entered by him. Fifty acres of contour furrows have proved their worth on this type of country. A further area had been cultivated and sown to pasture with a cereal cover crop. The further development of the property is somewhat hampered by the lack of sufficient fencing and water supply. The property is, however, still in the developmental stage and these drawbacks no doubt will be overcome in due course.



When a dam is placed in the middle of a valley as above, it is difficult to provide a safe spillway and the dam is readily over-topped in the event of a severe rainstorm.

Mr. Ronald Spencer, also of Benambra, has an area of contour furrowing. The site is a hill which was in rather bad shape on the northerly and westerly aspects, and the results have been outstanding.

Contour furrowing was also a feature of the entry submitted by Mrs. O. Hyland. The furrowing was completed approximately five years ago, and a complete cover of the furrow and bank has been effected. A diversion bank carrying the water from a roadway and spilling it gently into the furrowed area has proved

effective. A further area has been surveyed for contour furrowing, but at the time of inspection the furrows had not been ploughed.

Mr. H. Nicholas of Benambra has a property that is being developed along sound lines. The pasture cover throughout the property is a feature. While the general subdivision is good, the proposed alterations to subdivisional lines will further facilitate grazing control.

Attractive home surroundings and fodder reserves indicate two important aspects of rural life—contentment in the home and stability of production.

Mr. R. K. Love is another entrant who has only recently acquired his property at Omeo. Some furrows have been marked out on the contour and plans are in hand for further subdivision and improvement to water supplies. The planting of willows along a scouring creek by a previous owner has provided excellent control.

Mr. Owen H. Pendergast, Benambra, has constructed two well-planned drop structures on active scours. Complete control of the headward erosion of the gullies seems to have been achieved. The pasture cover throughout the property was very good and consisted mainly of native grasses with some clover, and is supporting cattle and sheep in the proportions of one beast to twenty sheep. It was considered that the general paddock size was somewhat large for effective grazing control, but this feature is one that can be remedied later with comparative ease.

The property of Mr. C. M. Tice is in the developmental stage and good results are apparent with improved pastures and topdressing with superphosphate. Topographical features of the property make a satisfactory farm layout rather difficult.

Mr. W. F. Faithfull, Omeo, has made excellent use of good proportions of sheep and cattle in his attempt to establish a satisfactory pasture cover over his property. The abundance of perennial rye grass and white Dutch clover growing voluntarily indicates that these plants would do well in the more favoured localities of the district.

Mr. J. W. Bales, Omeo, has approximately one hundred acres contour furrowed. The initial liberal topdressing of superphosphate with surface sowing of subterranean clover should do much to improve the fertility and increase production from the property.

The entry submitted by Mr. D. H. Hallett of Omeo demonstrates the effectiveness of superphosphate. A paddock of Phalaris tuberosa and subterranean clover had been well established and is providing a big increase in carrying capacity over the native pastures.

Fodder reserves on the Benambra property of Mr. W. H. Jarvis.

Cattle grazing on a 16-year-old lucerne stand in the Walwa district.

Mr. L. V. Brown, Tallangatta, has carried out some effective work by planting willows along the bank of a permanent creek. In addition, groynes constructed in the creek bed have diverted the flow of water from the eroding creek bank to its original course. These groynes also had the effect of protecting the newly-planted willows.

Mr. W. S. Cheshire, "Forest Lodge," Burrowye, entered a property that presents many problems of management, but excellent pasture cover has been gained over most of the farm. The advantages to be gained by care and attention to pastures were amply demonstrated by this landholder.

Mr. W. B. Lawrence, "Willsburn," Walwa, has relied upon vegetative cover for the control of erosion. Particular care has been taken in the choice of grazing animals and the time of the year they have been permitted to graze the steep country. A seeding period has thus been assured to maintain the grass and allow a certain amount of vegetative cover to decompose each year for the building of new soil.

Some areas in the steeper slopes have at some previous time eroded into gullies and Kikuyu grass has been planted with excellent results. This landholder has constructed some diversion banks or drains, and although the grade was considered to be too steep, the general flow of excess water has been interrupted. The immediate planting of Kikuyu grass along the drains has, by its vigorous growth, controlled any movement of soil.

A very interesting area of fifty acres was entered by Mr. A. Lawrence, Walwa. Some eight years ago the area was netted and rabbits completely eradicated. No grazing was permitted for two years, but subsequently the grazing of cattle in limited numbers was allowed. Although no artificial manures have been used, the fifty acres have been transformed from a condition of severe sheet erosion and sparse cover to one of good cover with effective control of sheet erosion.

The property of Mr. W. H. Fleming, Tallangatta, is used for the production of wool and dairy products and must rank high in any soil conservation competition. The most striking feature on this property, together with the quality and density of pasture cover, was the general line of subdivision. The steeper slopes had been fenced from the lesser slopes and the differential treatment given each section was most apparent. The higher country was grazed mostly during the winter and early spring, allowing the maintenance of a satisfactory soil cover during the season when protection against erosion is most needed.

In conclusion, the writer desires to thank competitors and others who co-operated in the conduct of this competition.

Survey of Soils, Land Use and Soil Erosion in the Coleraine District

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The first part of this paper appeared in the October issue of the Journal.

SOIL GROUPS OF COLERAINE

THE land use, fertility, erosion, and conservation characteristics of each of four main groups of Coleraine soils will now be discussed.

1. Podzolised Soils

Gritjurk Series	Hilgay Series
Koroite Series	Bryant Series
Brit Brit Series	Balochile Series
Konong Wootong Series	Series X
Hassall Series	Series Y

Land Use

Almost the entire area of the podzolised soils is in use for sheep and cattle pasture. The holdings are comparatively large, generally from 500 to 2,000 acres in size. Small areas occur on dairy farms. The pastures generally have not reached a high stage of development. There is a large area of natural pasture which is virtually unimproved and supports slightly less than one sheep per acre. Most of this pasture is on the tableland and is readily accessible to implements for improvement. By comparison much of the Konong Wootong soil occurs on steep hillsides which are inaccessible to most implements.

The tableland soils, Gritjurk, Koroite, and Brit Brit series are capable of considerable improvement by top-dressing with superphosphate and the introduction of subterranean clover and perennial rye grass or Phalaris tuberosa. With such methods, carrying capacities of between two and three sheep per acre have been reached, compared with approximately one sheep per acre before pasture improvement. So far, however, perennial rye grass or Phalaris tuberosa is comparatively rare on tableland soils. Subterranean clover is much more common, and is a major pasture constituent on probably half the area of these soils. In some pastures, used only for sheep grazing, clover dominance occurs.

The Konong Wootong and Hassall soils carry unimproved natural pasture over most of their area. The slopes on these soils are generally too steep for cultivation, and, for the same reason, even fertilizer distribution is almost impossible in some places. The unimproved carrying capacity of pasture on these soils is approximately one sheep per acre, but on improvement, more than two sheep per acre may be carried.

Soil Fertility

These soils are the most leached in the Coleraine area, with little organic matter and no free lime. They are slightly to moderately acid on the surface. As between the tableland soils, the Koroite soils appear to be less acid than the Brit Brit soils. Pastures on these podsolized soils respond very well to addition of superphosphate and to improvement in the nitrogen status of the soil.

Soil Erosion Hazard

The Gritjurk, Koroite, Brit Brit, and Balochile soils occur on flat ground and are unaffected by soil erosion.

The Konong Wootong, Hassall, and Series X soils are liable to sheet erosion if vegetative cover is destroyed. These soils are also affected by gullying, although this is confined so far to well-marked drainage lines. In the one instance on Konong Wootong soil, where gully erosion commenced on the side of a valley, it was certainly due to cultivation of the land. No portions of these light soils are cultivated now and the only possibility of destroying vegetative cover is through grazing or fires.

Over-grazing of pastures on these soils is apt to arise not so much from overstocking with sheep, as from lack of rabbit control. Heavy infestations of such vermin readily occur on these easily burrowed soils when vermin control is relaxed.

The Hilgay series is not seriously affected by erosion, but removal of vegetative cover renders it liable to sheet erosion by water or wind. It is also preferred by rabbits for burrows.

The Bryant soils are most liable to erosion either as the tunnelling (" water tunnels "), gully or sheet forms. It is also the only one of this group of soils which has any hazard of landslides.

Series Y soils, occurring mainly near meandering creeks, are subject only to stream-bank erosion which diminishes the area of useful pasture directly by soil wastage and by the accumulation of transported debris further downstream.

Soil Conservation

Konong Wootong and Hassall Soils.—The principle of sheet erosion control and ultimately of gully control is improvement of surface cover of the soil. It is thought that the introduction of the deep-rooting perennial grass, Phalaris tuberosa, may have some advantage on the Hassall soil, which possesses a water-retentive clay subsoil.

The possibilities of improvement on the Konong Wootong soil are restricted because of its lack of a clay subsoil and by the fact that slopes are often so steep as to prohibit even topdressing. Subterranean clover appears to be a valuable addition to the pasture on these soils though it can be added only where top-dressing is feasible. Where the clover is introduced care should be taken to prevent clover dominance. As far as soil conservation is concerned, it may be best to attempt no improvement of the pastures on these soils, more especially on the Konong Wootong soils, but maintain a satisfactory ground cover through pasture management and eradication of rabbits.

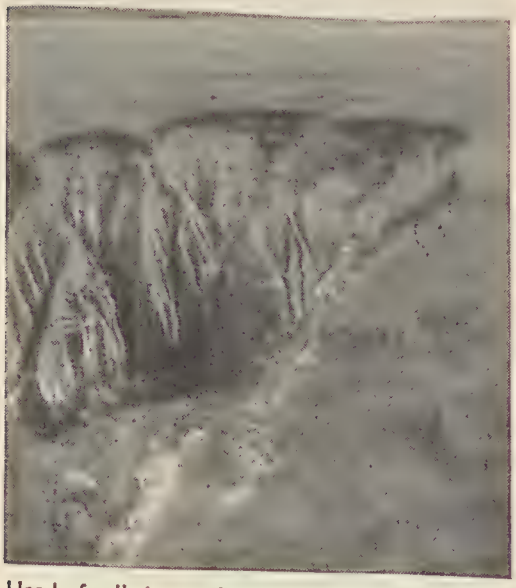
Whatever steps are to be taken the objective of restricting surface run-off should always be held in mind. This depends almost entirely on pasture management, which is affected by stocking rates and vermin control. Grass fires are a source of great danger to soil conservation in this area.

The associated erosion gullies would be among the easiest to control and revegetate as all gullies have granite bottoms, which prevent further rapid deepening. Planting of elms and poplars in and along gullies appears a satisfactory line of attack. Experiments may be necessary to find the most suitable grasses, creepers or shrubs to colonise the bare side of gullies. Fencing in of gullies may be necessary to permit rabbit control and subsequent growth of vegetation along gullies.

The use of contour furrows does not seem generally to be required on the Hassall and Konong Wootong soils for the reason that sheet erosion at present occurs only on small widely separated areas, whose control seems more a problem of pasture management.

Hilgay Soils.—The soil conservation programme is the maintenance of vegetative cover. The essentials are the elimination of rabbits and the fencing of these soils separately to control stock grazing, and to enable ultimate pasture improvement. Where practicable such soils might be sown with subterranean clover and Phalaris tuberosa.

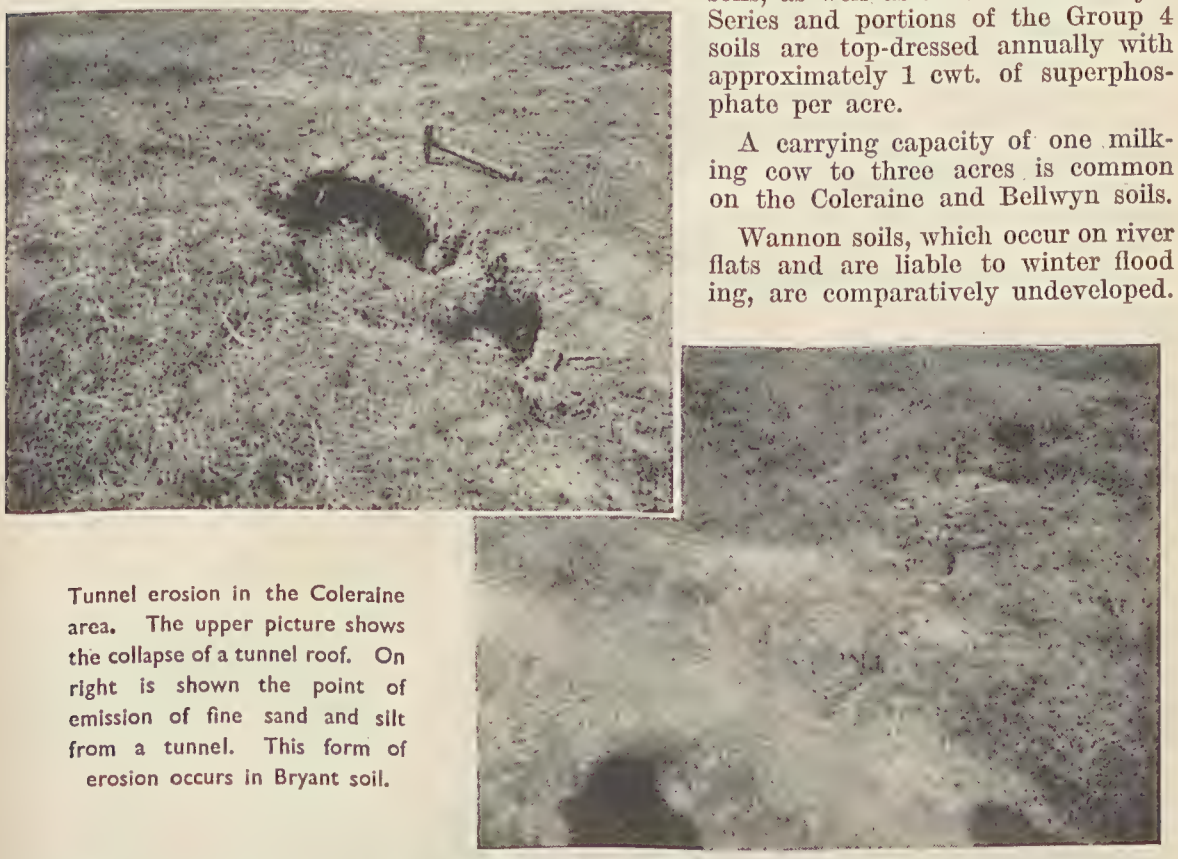
Bryant Soils.—The areas most affected by sheet erosion, tunnel erosion, or gullying should be fenced separately preparatory to rabbit elimination and establishment of tree plantations. Where road drainage waters aid erosion development, roads should be examined with a view to safer drainage elsewhere.



Head of gully in weathered granite associated with Konong Wootong soil. The fluting of pillars of weathered granite is characteristic. Absence of of trees except sheoaks is natural on this soil.

Methods of pasture improvement, particularly the suitability of a mixture of subterranean clover and Phalaris tuberosa should be examined. Contour furrows generally are not warranted at present on these soils which can gain a great deal more protection by rabbit elimination, improved pasture varieties, and control of stocking, in particular the control of sheep camps.

Series Y.—Some areas of these soils are subject to stream-bank erosion and to accumulation. These twin evils are interconnected and so long as coarse material is being washed into the area from further upstream it will be impossible to eliminate stream-bank erosion. However, some minimizing of this may be obtained by tree planting with willows, poplars, and eucalypts along creek banks. Groynes should be installed in critical situations where roads or bridges are threatened.



Tunnel erosion in the Coleraine area. The upper picture shows the collapse of a tunnel roof. On right is shown the point of emission of fine sand and silt from a tunnel. This form of erosion occurs in Bryant soil.

2. Black Earths:

Bellwyn Series	Parkwood Series
Coleraine Series	Wannon Series
Whyte Series	Group 4.

Land Use

All but one of these soils occur below the tableland. The exception, Parkwood series, occurs in poorly-drained depressions on the tableland and little use is made of such soil at present. All other soils are used largely for dairying with holdings of from 150 to 250 acres. The Bellwyn and Coleraine soils are the most intensively used soils of the area. Over much of these soils perennial rye grass and subterranean clover have been sown, with good results, but even where such sowings have not been made both these plants have become firmly established and are important constituents. Both of these soils, as well as most of the Whyte Series and portions of the Group 4 soils are top-dressed annually with approximately 1 cwt. of superphosphate per acre.

A carrying capacity of one milking cow to three acres is common on the Coleraine and Bellwyn soils.

Wannon soils, which occur on river flats and are liable to winter flooding, are comparatively undeveloped. Rushes grow thickly on such soils. While it is true that the rush growth affords some protection for stock, particularly lambing ewes, in winter time, it is clear that better utilization of the soils would be made if the correct methods were found. One suggestion is their possible use for fodder production under irrigation. Another possibility is the use of strawberry clover, which might also have value in the development of the Parkwood soils.

Gully development in Whyte soil showing active enlargement at head of gully. Note depth of black earth over pale-yellow alluvium.

Soil Fertility.—With one exception, these soils are probably the most fertile in the Coleraine area. They are slightly acid in the surface and have lime present in the subsoil. All but the Parkwood soil have a moderate to high content of organic matter. Pastures growing on them respond to dressings of superphosphate. The Parkwood soil is an exception for its content of organic matter and nitrogen is low, possibly due to a recent history of water-logging and salinity.

Soil Erosion Hazard

Parkwood soils occur on the tableland and have no erosion hazard.

Bellwyn and Coleraine soils were not observed to be affected by sheet erosion except on very small isolated areas. Run-off from these soils helps in the development of erosion gullies in the Whyte soils lying in the smaller valleys. These two principal soils of the valley sides are liable to landslide movement, but only where they lie immediately downslope from tableland areas or where instability arises at a geological contact as a result of water movement and exaggeration of slope due to gully action or stream-bank erosion.

The Wannon soils, occurring on flood plains of the Wannon River and Koroite Creek, have no serious problems of erosion or deposition. On the Wannon soils along the lower reaches of the Koroite Creek, deposition is limited to fine material. This sediment is in effect a top-dressing to pastures, for it includes some of the most fertile top soil from other areas. Analyses show this deposit to be better than average as regards content of phosphorus compounds.

Among this group of black earths the Whyte soils are the most ravaged by erosion. Along the Koroite Creek they are affected conspicuously by sedimentation and stream-bank erosion. Erosion gullies in the Whyte soils are the largest in the Coleraine area. These gullies appear to be extending rather quickly. Once the erosion gully has penetrated vertically through the horizons of the heavy black Whyte soil gully formation is hastened. The alluvial material underlying the soil is of a silty character and has little stability when wet.

Deep gullies with almost vertical walls are the general expression of such erosion. Bedrock is sometimes encountered at depths of 20 to 30 feet from the surface, but as this is generally either glacial material or soft Jurassic deposits, no serious obstacle may be presented to further deepening of the gully.

The Group 4 soils, although developed on ancient landslides, now appear to be fairly stable and only in danger of sheet erosion on very steep slopes.

Soil Conservation

Bellwyn, Coleraine, and Whyte Soils.—The chief problem is the control of gullies in Whyte soils which generally lie downslope from soils of the Bellwyn or Coleraine Series.

Retention of the greatest amount of rainwater for the longest period is desirable to reduce the load of water entering gullies. Moreover such retention is most desirable from the soil conservation aspect at the time when it is also of greatest use for pasture growth, that is, in the dry season of the year. It is in this period that intense falls of rain are most likely and most undesirable, for with a scanty vegetative cover the run-off is heavy and rapid, leading to gully extension and flooding as well. The principal points in control of erosion are as follows :—

(1) Avoidance of cultivation on steeply sloping soils. Most of the cultivation now undertaken of Coleraine soils is on land

too steep to be cultivated with safety from erosion. Where cultivation is essential in order to sow down areas for permanent pastures, the cultivation should be arranged so that water is held in the soil rather than drained downhill along cultivation lines. Even a final harrowing somewhat along the contour may be a useful practice. Exposure of bare cultivated land through the dry season should be avoided.

(2) Pastures should be allowed to retain a good vegetative cover throughout the summer. Clover dominance should be prevented in pastures by grazing cattle on holdings which are used mainly for sheep. Phalaris tuberosa should be sown in those areas where rye grass has been killed by grass grubs. Rabbit control is essential, but fortunately most of the Coleraine series are not much affected by rabbits at present, although erosion gullies still offer harbour for these vermin.

(3) Temporary diversions of water from gully heads will generally be necessary to enable re-vegetation of the bare gully heads. Structures of concrete may be useful in some gullies to prevent their further deepening and consequent broadening. However, no great reliance should be placed on structures as a means of filling gullies by siltation. Structures are of no use in conservation practice unless there are also other measures designed to prevent any further movement of soil and to slacken run-off from the head or sides of the gullies. The idea that structures are useful in damming back sediment and ultimately filling in present gullies is fundamentally unsound, even though it may have some immediate practical advantages.

(4) The drainage of roads near gullies should be designed to make the least interference with the natural drainage of the area.

(5) Contour furrowing will be useful on sloping areas where vegetative cover is temporarily impaired, provided that such areas do not lie down the slope from an area of table land.

(6) Re-vegetation of deep gullies should be undertaken together with the elimination of rabbits. Lucerne and deep-rooting perennial grasses, such as Phalaris tuberosa should be useful. Experiments should also be made with rushes, reeds, creepers, and trees.

Wannon Series.—These soils are affected by stream-bank erosion but even more by accumulation of flood debris, thus increasing the flooding hazard to low-lying areas. Protection of the catchments of the creeks involved is the key to long-term solution of the problem, but even so, protection of stream banks is essential to minimize the loss of productive land. Tree-planting should be undertaken along stream banks and groynes should be concentrated at points where bank erosion threatens roads or bridges.

Portion of the Dundas table-land, looking eastward across the valley of the Koroite creek, with Mt. Dundas in the distance. Note level skyline of tableland on right and timbered nature of country.

The top picture shows a landslide which developed after the 1946 floods. In the lower picture the scar at the head of this landslide is shown; length of scar about 2 chains. Note typical profile of tableland soil with pieces of ironstone in left foreground.

The chocolate Beerik soils respond particularly well to superphosphate and it is possible that additions of lime may be profitable. Generally these soils are located on elevated sites and are rather too well drained for growth to continue far into summer. The Swan soils are better in this respect, as they occur on hillsides and valley slopes which receive run-off and soakage water from the higher areas. These vary somewhat amongst themselves, particularly with regard to soil structure and its suitability for cultivation. A small amount of potato production takes place on Swan soils.

With the exception of Group 2 and Group 3 soils, the volcanic soils fall within the Closer and Soldier Settlement areas, where the holdings are approximately 200 acres in size.

3. Volcanic Soils

Beerik Series	Group 1
Swan Series	Group 2
	Group 3

Land Use

These soils are used mainly for dairying with grazing of sheep and cattle and production of potatoes on smaller areas. The largest extent of the volcanic soils occurs in the high rainfall portion of the Coleraine area. The chocolate Beerik soils and the black Swan soils are easily recognizable in this area and they have a reputation for fertility and productivity. These two soils are used particularly for dairying, though a few holdings graze sheep and cattle.

A high proportion of the Beerik, Swan, and Group 1 soil area is covered with sown pastures of perennial ryegrass and subterranean clover; the remainder carries top-dressed natural pasture among which subterranean clover and perennial rye grass have spread as volunteer plants. Carrying capacities of up to three sheep per acre have been achieved.

Soil Fertility

The volcanic soils in the high rainfall portion of the district are moderately acid on the surface and usually are acid in the subsoil as well. In a few cases lime was found in the subsoil, more especially with soils on basalt but not all basaltic soils have calcareous subsoils. The black soils have a high content of organic matter. Both Beerik and Swan soils, but particularly the latter, grow patches of thistles where the surface soil has been disturbed. The Group 1 soils include some less fertile brown and grey gravelly soils.

Soil Erosion Hazard

The Beerik and Swan soils are usually covered with vegetation and are not affected by soil erosion.

Gullying and landslides affect only the margins of the Swan soils. The Group 1 soils have erosion gullies associated with slumping. These gullies are proving particularly hard to control, probably because there is no consolidated material reasonably close to the surface.

The Group 2 and Group 3 soils are not affected either by gullying or apparently by sheet erosion.

Soil Conservation

Beerik Series.—It is important to prevent the onset of sheet erosion by cultivating only the gentler slopes and by maintaining on pasture land a thick continuous cover of vegetation, particularly throughout the dry season of the year.

Swan Series.—The occasional mud flows occurring on some areas are already well covered with vegetation. There are a number of small landslides and slumping gullies at the margins of some Swan soils. These are generally in connection with unstable glacial material which is in movement along erosion gullies. No practical recommendations can be made for the prevention of landslides in such conditions, although of course a good pasture cover is essential to minimize water penetration, an important factor in development of landslides. It is important to halt the headward erosion of gullies in and near volcanic soils.

Group 1.—There is some risk of sheet erosion which should be averted by pasture improvement and management to protect the vegetative cover of the soil. The main trouble at present arises from gully erosion. In one place where this erosion is particularly bad, re-direction of road drainage is advisable and re-direction of the road itself may be desirable to allow sufficient space for growth of trees, shrubs, and grasses to bind the soil at the gully-head. Experiments are needed to find plants which will quickly colonise the clay exposed in this gully.

Groups 2 *and* 3.—Sheet erosion could commence in the event of over-grazing, leading to the ultimate ruin of the vegetative cover and damage to the valley lands below.

4. Miscellaneous Soil Complexes

Group 5	Group 7	Skeletal
Group 6	Group 8	

Land Use

These soils are mainly used for grazing sheep and cattle. The grazing is practically all unimproved natural pasture and many areas are inaccessible to top-dressing implements.

Soil Fertility

The soils are variable but are generally rather low in fertility and yield only poor pastures. Some of the shallow skeletal soils on volcanic rock are probably more fertile than the soils developed on landslide debris.

Soil Erosion

The skeletal soils are affected only by sheet erosion, to an indefinable extent. The other soils are all affected to some extent by sheet and gully erosion. Landslides are common.

Soil Conservation

The landslides are probably uncontrollable to a very great extent, but two suggestions are made for their reduction. Firstly, groynes could be used to divert Koroite Creek further to the east at its bend from south to west. This action would permit the steep west bank of the creek more opportunities for stabilization, thus reducing the landslides which occur in this locality.

Steep-sided gully in Whyte soil. Note depth—approximately 30 feet—vertical sides and cracking.

. Secondly, a re-afforestation of the areas of Gritjurk soil to the west of Koroite Creek, near the above locality, would reduce the amount of seepage through the tableland and probably reduce the hazard of landslides there. Thirdly, it is desirable to undertake any measures, such as good pasture management, which enable soil organic matter to be increased. This will increase the water holding capacity of the soil, diminish summer cracking of the soils, and thus limit the amount of deep water penetration that is apparently connected with landslide development. The control of landslides may be possible if the lower layers can be dried and maintained dry.

A rigid emphasis on the use of vegetation is undesirable as landslides have occurred, at least in other countries, despite the growth of surface vegetation, including trees. Obviously there is room for a good deal of experimental work with vegetation in the case of the Coleraine landslides. The most useful experimental work would be that undertaken, bearing in mind all the factors—geological, geographical, hydrological, botanical, pedological, agricultural—that affect landslide development.

Many of the stony areas, where vegetation is so desirable to reduce run-off and danger to valley bottoms, are quite large and are infested with rabbits. Adequate rabbit-proof fencing and a regular attack on rabbits within the fence are essential, both as a safeguard to adjoining areas and to limit sheet erosion and run-off from the skeletal soils.

CONSERVATION IN PORTION OF THE GLENELG CATCHMENT AREA

The two parishes surveyed in detail at Coleraine appear to include most of the soils and types of erosion over an area of approximately 2,500 square miles in the Glenelg catchment, bounded roughly by Casterton on the west, Harrow at the north, the Grampians at the east, and the Wannon River to the south.

Throughout this area evidence of the ancient tableland is always visible. Ironstone soils comparable with those of the Coleraine area occur on the tableland remnants. The improvement of these soils and their pastures is receiving constant attention by landholders.

In areas where the valleys are shallow and do not cut far into the tableland, the soils are comparable with the Group 8 soils at Coleraine. These occur at the headwaters of the main creeks. Many such valleys carry vegetation along drainage lines and generally erosion is no great problem.

Deeper valleys carry soils which vary according to the nature of the local bedrock. Thus to the south and east of Coleraine, the Coleraine and Whyte series are the main soils of the valleys, with possibly some occurrences of Hilgay soils on hilltops. This country is used largely for dairy production and excellent pastures have been developed. In this area, landslides appear in no greater proportions than in the Coleraine parish. Gullying, siltation, and stream-bank erosion, with isolated areas of sheet erosion, are the main problems in soil conservation.

The catchment area of the Koroite Creek also has deep valleys, many of which expose granite. The Konong Wootong and Hassall soils may be expected in these valleys, with Brit Brit soils occurring over much of the

Sedimentation along a permanent creek near Wando Vale. In many places the sediment is too deep and coarse for rapid re-vegetation.

tableland remnants. Areas of Bellwyn and Bryant soils have not been seen outside of the Coleraine district. It is in the Koroite Creek catchment area that much of the severe erosion has taken place. Sheet erosion on the coarse, sandy podzolised soils, severe gullying in deeply weathered granite, stream bank erosion and sedimentation are common problems north-east of Coleraine. Landslides occur notably near Coleraine along the Koroite Creek and its tributaries, but are not apparent further upstream.

Over much of this area north-east of Coleraine, where granite and kindred rocks form the basement of the country, pasture improvement is essential to control loss of soil.

To the north of Coleraine there is a high area from which creeks drain away in all directions. In this district there is relatively little soil erosion, except where deeper, narrower valleys occur. The soils appear mainly to be Brit Brit, Group 8, and Hassall soils. Where gullies have developed, their control in most cases appears to be possible by re-vegetating the eroded soil after temporarily diverting water by means of graded banks.

Around the fringe of this central high portion, valleys are deeper, erosion becomes a feature of drainage lines, and a number of rock outcrops may be found. On the Coleraine side, there are, of course, several outcrops of volcanic rock, and an area of fertile black (Swan) and chocolate (Beerik) volcanic soils runs in a narrow belt roughly north-east and south-west. In the Tulse Hill district there are also smaller areas with outcrops of volcanic soils, and there are other occurrences as at Nareen.

The outcrops of volcanic rock have a practical value in soil conservation, as it is their presence as rock bars in numerous creeks which often controls creek deepening and headward erosion. In some cases they will be of use for receiving drainage water temporarily diverted from erosion areas.

Along the major watercourses, stream-bank erosion and sedimentation occur where erosion of the catchments is taking place. The Koroite Creek and Wando Vale Creek are two such watercourses. As soil erosion and sedimentation proceed, floods are apt to become more common as rates of run-off increase after sheet erosion.

Sedimentation also renders new areas liable to flooding and is causing actual loss of productive soil along river banks and the filling in of natural watering places for stock.

It can be understood from the foregoing material that a large proportion of the Glenelg catchment has some serious problems of soil erosion, which are in the main due to land use methods since white settlement of the area. It is not impossible to control the erosion. Soil conservation should be undertaken with a wide perspective of the problem, seeing the problem not as that of erosion on so many individual farms, but as affecting whole catchments. There can be no mechanical method of soil conservation, as by the rigid carrying over of methods successful in another district and imagining that here also they will be successful. Contour furrows may or may not solve the problem in these areas. In some areas they are almost unnecessary—the rabbits are the chief problem.

In any case the methods to be undertaken should depend on a thorough assessment of the problem. In this regard it is important to emphasize the danger of fire as an agent of soil erosion. No amount of advice as to adequate summer cover of soils will be followed thoroughly while farmers are troubled by risks of fire and drought. All the soil conservation measures necessary should be accompanied by a much greater development of grass-fire control which presents a real danger in this hilly area. It is possible that the hilly nature of the country may hinder rapid development of fires, but if fires should be followed by rains at all comparable with those of 1946, the result would be calamitous.

Fig Growing in Southern Victoria

By W. A. Rolfe, Orchard Supervisor

ALTHOUGH there are approximately 400 varieties of fig in existence, those known and grown in southern Victoria are very few. White Genoa and White Adriatic are the main ones grown by private gardeners, while a variety, Black Genoa, is the main commercially grown variety. There is no record of Black Genoa in overseas publications however, and it is possible that this is a local name and that the variety is actually Black Ischia.

Situation

It is important, from a commercial standpoint, that figs should be given the right aspect and situation. The fig originated in southern Europe and can be damaged by frost. Injury from this cause can be severe on young trees and in older ones results in damage to the fruiting laterals, with almost certain loss of the early crop known as the "brebas".

A further important point is that if the weather is cool in the autumn, the second or main crop, known as "Synconia," will not ripen. Generally speaking, if the grower cannot start harvesting at the end of March, he will lose part of his crop through immaturity.

During the past two seasons, quite a percentage of the fig crop was lost through lack of sunlight and warmth in the autumn. Figs should be given a north-easterly aspect and planted on high land so that they will suffer the minimum amount of damage from frost and obtain the maximum amount of warmth and sunshine. The fig is accommodating in respect to soils but prefers a well-drained deep loam.

Propagation

Propagation is simple. Cuttings from the desired variety are made of well-ripened yearling laterals from 1 foot to 18 inches in length. These are planted in nursery rows during the winter, and in the following year can be transplanted to their permanent position. Cuttings are preferred to suckers as the tree produced from a cutting is less liable to sucker than one produced by the latter method. If desired, shield budding or cleft and bark grafting can be practised.

Planting Distance

To facilitate harvesting operations, it is desirable to produce small low-set trees. A planting distance 18 feet x 18 feet or 18 feet x 16 feet is therefore desirable.

Fig trees bear their summer crop on the new growth. As the branch grows and a new leaf appears, another fruit develops in its axil.

[After U.S. Dept. Agric. Bull. 1031

Pruning

Most non-commercial fig-trees are usually left unpruned and, as the fruit is borne at the axils of the leaves on young wood, the tree soon assumes a sprawling untidy habit. The cutting back of all the long laterals in winter will cause three growths to come from just below the cut. This will result in an improved appearance of the tree and an increase in the second or Synconia crop.

Commercial growers who attempt to produce a first-class product for high-grade fruit shops, have evolved an unusual system of pruning. During the winter the tree is almost skeletonised except for a few short laterals which are left untouched. The remainder of the laterals are spaced approximately 1 foot apart, about 2 or 3 inches of the lateral being left. This results in the first crop, which is rarely of much value, being drastically reduced. The second crop comes from the new growth and matures about March–April. As previously mentioned, this crop needs some warmth to ripen it, hence the importance of a sunny situation. The fig has the ability to re-furnish itself, and will break from old wood, consequently the pruner is usually presented with an adequate supply of lateral growth.

Pests and Diseases

The growers' main worry is damage by birds which eat the fruit as it ripens. Apart from birds the only other trouble is a scab which sometimes forms on the fruit. This can be controlled by the use of a Bordeaux spray in the dormant stage.

Irrigation

To obtain the best results, natural rainfall should be supplemented so that the trees will grow through the summer without a check. Usually three irrigations will be enough.

Fertilizers

Owing to variations in soils, it is difficult to specify the quantity or type of manure to be added, but an annual dressing of three quarters of a bag of fowl manure per tree appears to have some value.

As the fig is shallow-rooted, cultivation should not be practised near the base of the tree and should not be deep in the centre of the lands. Sufficient cultivation to suppress weed growth is all that is required.

Harvesting and Marketing

As contact of the operator's hands with the leaves, and to a lesser extent with the fruit, has an irritating effect, the wearing of cotton gloves is advised. After picking, the fruit is packed and sold in trays. Smaller sized are usually sold in bushel cases. A fig tray is a long bushel pear-case cut into three sections from top to bottom. This gives three trays each with two sections. Cleats are placed on the top of each tray. The ripe fruit is packed in a single layer, woodwool being freely used underneath the fruit. Amongst the high-grade fruit shops there appears to be a good demand for these trays at prices from 8s. to 15s. per tray Three bushels per tree is not an uncommon crop.

Transplanting Vegetable Seedlings

Use well-developed seedlings and plant in the cool of the evening. Keep as much soil on the roots as possible. For convenience in planting, arrange tall seedlings, such as cabbage, cauliflower, and onion, in a bundle so that the bases of their stems are level. Then with one cut of a sharp knife trim the roots to a uniform length.

Correct depth of planting is important. Too deep or too shallow planting are equally undesirable and most seedlings should be planted so that the stem of the lowest leaf is brought to ground level. After planting, firm the soil around the plants and water them, preferably with a solution of ½ oz. of sulphate of ammonia or nitrate of soda and 1 oz. of superphosphate per gallon of water or very weak liquid manure applied with a watering can. In hot weather shelter transplants with, for instance, small flower pots or pieces of brushwood.

[Contributed by the Horticultural Division.]

Garden Notes for December

By George Hyam, Horticultural Supervisor

THE FLOWER GARDEN

Bedding Plants from Cuttings

THE propagation of woody plants by means of cuttings is a common practice. However, it is not generally realised that this method can be applied to many soft-wooded bedding plants such as pansies, violas, verbenas, pentstemons, lobelias, antirrhinums and practically all biennial or perennial plants which form side shoots on stems. Similar plants which grow from crowns or rootstocks are better propagated from division or from new shoots early in spring in a manner similar to that used for chrysanthemums.

The advantage of vegetative propagation by rooting cuttings of plants, commonly raised from seed, is that such plants will be an exact reproduction of the parent plant in relation to the colour and form of its flowers. It is possible by this method to build up superior plants of any species capable of being propagated in this way by careful selection of the plants from which cuttings are taken. Many of the choice pansies seen on the show bench are raised in this way. The method is particularly applicable to spring and winter-flowering bedding plants, and rooted cuttings from these often establish better than seedlings when planted out in hot weather for late autumn or winter flowers.

Plants for such cuttings are best selected in November when they are in flower, so that the desired colour and quality of flower can be assured. The ideal cuttings are side shoots taken in December which have not flowered, or which do not show a bud. They should be plump and firm-stemmed, and these will generally be found on the outside of the plant and on the sunny side. The length of the cutting will vary according to species, but they range from about three or four inches in the case of taller plants such as antirrhinums and pentstemons, to one to two inches with pansies. Hollow-stemmed cuttings have less chance to root than those with solid stems.

The preparation of the cutting consists in trimming the end close to a leaf-bud, and stripping off any leaves or stipules from the portion to be inserted in the propagating sand leaving the topmost leaves intact. The best striking medium is a moderately coarse-grained washed sand mixed with peat (which is now obtainable) at the rate of 4 parts sand to 1 part of peat. Sieve the mixture to ensure an even texture.

The best containers for the rooting media are five-inch flower pots which will accommodate about 20 cuttings and are easy to keep under the shelter of the frame which is necessary to prevent the rapid drying out of the sand in hot weather. Small lots can be covered with wide-mouthed glass jars for this purpose. Some soft-wooded cuttings have shown a good response to the powder form of root-inducing hormone preparations, using the special soft-wooded type.

The cuttings should show evidence of rooting by top-growth in three or four weeks from insertion, and they can then be pricked out in boxes or pots of ordinary soil to grow on to planting out size.

A few summer flowering plants such as salvias, bedding begonias and alteranthera can likewise be propagated from cuttings taken in March and April, but these have to be nursed under cover during the winter and early spring for planting out in the following October and November.

Propagating Shrubs by Layers

For the amateur, layering is the easiest way of propagating hard-wooded shrubs. This method is not used a great deal by commercial nurserymen, as the number of layers that can be made from one stock plant is comparatively small, compared with the amount of cutting wood which one plant supplies. Propagation by some forms of layer is possible from any plant that can be raised from cuttings, other than those which are normally propagated from tip-cuttings, such as ericas and many of our native shrubs.

The most common method is dependent upon the parent plants having fairly low-growing branches which can be brought down to a horizontal position and partially inserted under the soil surface alongside. As the layer is still attached to the stock plant, which continues to supply sap to it, rooting is quicker and safer, and a layer can be left to grow on to planting size before severing from the parent. Actually there are different forms of layering, the most common being the "simple layer" which for most plants is best put down in December, especially for spring flowering plants like daphnes, rhododendrons, azaleas, camellias and other evergreens. The method is shown in the illustration, the main principle being to make a diagonal slit on the underside of the stem near to a node or bud, in a position which, when pegged down, will be at the lowest point under-ground. The essentials are that some terminal growth shall be above the surface and that this shall be firmly anchored to a vertical stake. Also the under-ground portion should be firmly held with wire or wooden pegs to avoid any movement which would prevent rooting. If the stems are brittle or very thin, a small square of bark extending over about half the diamater can be removed adjacent to a bud instead of the horizontal slit to avoid the possibility of fracture.

The soil over the layer should be light and sandy and this should be introduced if the natural soil is heavy. Most layers

Simple layering. Note how the branch is bent down; a slit has been made in the stem at *a* and he'd open by a pebble, *b*; a peg, *c*, holds the layered branch firmly in the soil, and the stake, *d*, keeps it upright.
[After A. C. Hottes

from woody plants are best left for 12 to 18 months before separating for transplanting. The long vines of climbing plants can be layered by the "serpentine" method which consists of burying and notching them at intervals over their whole length, thus forming a series of loops above ground. Where there are no suitable stems for bringing down to soil level, the "air layer" can be used as illustrated. If a flower pot is used, this is sawn in half with a hack-saw and the two halves wired round the stem. This method is particularly suitable for camellias and other plants whose limbs tend to grow erect.

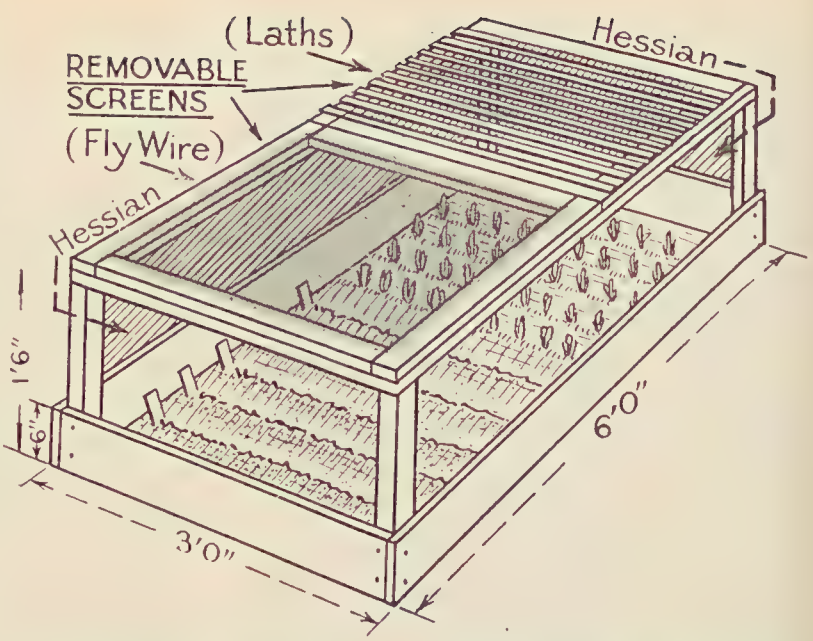
Air layering. "A" shows a branch notched preparatory to layering. The centre cutting is of a Chinese layer, the notch covered with a ball of moist moss. "C" is a pot layer. The pot is filled with moss or sand.
[After A. C. Hottes

The main attention required is to see that the soil around the layers is not allowed to dry out and this applies especially to "air" layers which will require frequent watering during hot weather. Any weeding around layers should be done by hand to avoid disturbance of the developing roots.

Summer-time Seedling Raising in Small Gardens

Many kinds of seedlings, including those for winter flowering, have to be raised in the height of summer heat and the problem is to provide some shelter from extreme conditions without making them too soft when planting time comes.

An efficient seed bed can be simply constructed. A bed measuring about six feet by three feet is sufficient for the average garden and this is best located in a sunny place. A frame is constructed as illustrated, and placed over the bed for mild protection. The base boards constructed from six inch by $\frac{3}{4}$ inch timber give sufficient side protection. The north and west sides are screened by tacking hessian or canvas to the top bar and base; the south and east sides are left open. Top shelter is first given by two three-feet by three-feet fly-wire screens which will pass ample light and air, and will break the force of any heavy rain, also allowing the seeds to be watered through them with the hose.



A summer seedling frame. "A" is a removable fly-wire top-screen for germinating seeds. "B" is a removable lath top-screen for hardening off. The north and west sides are screened with hessian. The south and east sides are open.

Until the seeds are all through these screens are covered with a hessian cover which is removed as soon as the first leaves develop. Final hardening-off is effected by replacing the fly-wire screens with lath screens. The frames should be portable so that they can be readily moved to a new site and fresh soil for following sowings. Such light protection reduces the frequency of waterings without unduly forcing the plants.

THE VEGETABLE GARDEN

Harvesting Herbs for Drying

Sage, thyme, marjoram and other less commonly grown herbs are for some culinary purposes, best used when dried, although for others, sprigs of fresh new growth is to be preferred. The secret of quality in dried herbs is to harvest when the plants contain the maximum amount of the essential oils which give them their flavour and aroma and to dry them in such a manner that this is conserved. Flavour is at its highest when these herbs are about to flower. This occurs from November to January and occasionally at other times if fresh growth is being constantly picked for use.

Whether the spring growth is used for drying or not, December is a good time to trim the bushes to induce further growth in summer and autumn and to avoid a superabundance of woody growth with sparse foliage. For drying, harvesting is best done early in the day well before the midday heat. Sage, thyme and savory are headed back to the previous season's growth while marjoram and tarragon are cut off nearly to ground level. Grasp as many stems as possible with the left hand and cut off with secateurs or a sharp knife, tying each handful into a loose bunch. Do not expose cut bunches to hot sun but place them under cover as soon as possible. Herbs are best dried out in a moderately cool, dark place which has plenty of air-circulation. The bunches should be spread out on trays or shallow boxes lined with paper to catch fallen leaves as they dry. Allow air circulation between trays if these are stacked. No artificial heat should be used except in humid climates.

The bunches should be turned every day or so, and if large quantities are to be dried, trays covered with hessian as the base are best to use as a stick can be used to knock the hessian and thus shake the herbs without handling. Herbs are sufficiently dried when the stems crack and do not bend when handled. To avoid loss of flavour and colour and to prevent absorption of moisture on wet days, the dried product should be packed as soon as possible in air-tight containers, taking care that the herbs are quite dry before packing. Although the stems have a fair oil content, the best quality dried herbs are produced by rubbing the leaves off the stems when dry and before packing. This can be done expeditiously by gently rubbing through a fly-wire sieve.

The young leaves of mint and parsley can be dried at any time, but if harvested in December the dried product will have a better colour. These herbs will take rather longer to dry as they are more succulent than the woody kinds.

Harvesting Onions for Storage

Starting in November with the early varieties, and from that month until February for the late long-keeping sorts, there is a succession of different kinds of onions reaching maturity.

Although these vary in storage capacity, any of them will keep longer if some hints for cultivation, harvesting and storage are observed. After onions are well into the bulbing stage, the beds should not be overwatered as this will keep the foliage green longer than is normal, and retard the proper ripening of the bulb. Keeping onions in growth past their usual season greatly reduces their storage capacity and is the cause of storage rot. Onions root deeply, and in all parts of the state, there is usually sufficient soil moisture to carry them on to maturity from the bulbing stage without irrigation, except perhaps in dry northern areas.

Onions also have a short storage life if harvested prematurely. In districts of a low late spring and summer rainfall, they can be left in the ground until the foliage dies down. Under more humid conditions, onions are best lifted as soon as the foliage falls over and starts to yellow, and they can be harvested at this stage in other districts if the beds they occupy are wanted for other crops. When this is done, it is necessary to "cure" the bulbs by allowing them to lie on the surface until the foliage becomes dry and brittle, taking care that they are placed on their sides so as to shed any rain or heavy dew. Onion bulbs will not develop further once they pass the stage when the necks start to wilt and the foliage begins to lose the fresh green colour. Late plantings will mature at the normal time for the variety, along with those planted at the proper time. If their bulbs are then small, no extra time in the ground will increase their size.

In common with flowering bulbs, onions will store best when air circulates freely around them. Placing them on trays in single layers with air space between stacked trays, under cover from rain, will prolong their storage life. Small lots can be tied to sticks.

Early December is the time to lift any of the perennial onion-like bulbs such as shallots, potato and tree onions as well as garlic. In each case they should be lifted as soon as the foliage falls over, and then cured as for onions before storing. All these bulbs will quickly sprout into second growth if left over a long period in the beds and watered at the later stages of growth.

Other December Work in the Vegetable Garden

All summer vegetables can still be sown or planted in all districts. Early December is a good time to plant the main crop of tomatoes in late districts and during December late varieties can be planted elsewhere. Earlier planted vine vegetables will be coming into the flowering stage and, under garden conditions, it is advisable to restrict the length of the runners to promote lateral growth which carry most of the fruiting female flowers. Where only a few plants are concerned, these can be easily and quickly hand-pollinated to ensure a better set of fruits.

Wet and humid conditions tend to induce mildew and for that reason vine vegetables are best furrow irrigated rather than watered by overhead sprinklers in the cooler districts. Mildew at its first appearance can be checked by dusting with sulphur. Half strength Bordeaux mixture (2–2–40) can be used on cucurbits other than rock melons or cucumbers both of which are susceptible to Bordeaux injury. As a fungicide for these species American authorities advocate a dust made from 2 oz. copper-oxychloride mixed with 1 lb. of flour or talc with the addition of 2 oz. of calcium arsenate if pumpkin

(continued on page 520.)

SPAYING OF CATTLE

Contributed by the Veterinary Staff

THE operation, commonly spoken of as spaying, consists of the removal by surgical measures of the ovaries of female animals.

Spaying is practised on all domestic animals. Cows and heifers are so treated when it is desired to lengthen the lactation period and to hasten fattening and improve the quality of the beef.

Heifers may be spayed to limit numbers of a herd without culling; such animals fatten more quickly and grow faster than those not operated on. They are also quieter and caus less disturbance in the herd.

Cattle may be spayed from the age of si weeks, at almost any time of the year, an whether they are fat or poor. It is advisable however, to wait for suitable weather conditions, and if exterior methods (flank or ventral) are adopted, the operation should be performed when the weather is cool and when the pastures are green and flies are not troublesome.

Methods

There are three methods of spaying:—(1) the flank method; (2) through the vagina; and (3) through the under surface of the abdomen or belly in front of the udder. (The latter method is adopted only for calves or other small animals.)

EQUIPMENT REQUIRED.

(1) Spaying emasculator.
(2) Sharp knife.
(3) Clippers or curved scissors to remove hair.
(4) Some strong half-curved needles.
(5) Pair of needle-holders.
(6) Strong suture silk or strong gut in reel.
(7) Pair of artery forceps.
(8) Roll of absorbent cotton wool.
(9) Bottle of antiseptic (dettol, lysol or similar preparation).
(10) Bottle of methylated spirits or tincture of iodine (to paint skin prior to incision).
(11) Cake of soap and towel.
(12) Clean buckets with supplies of warm water for cleansing hands, &c.

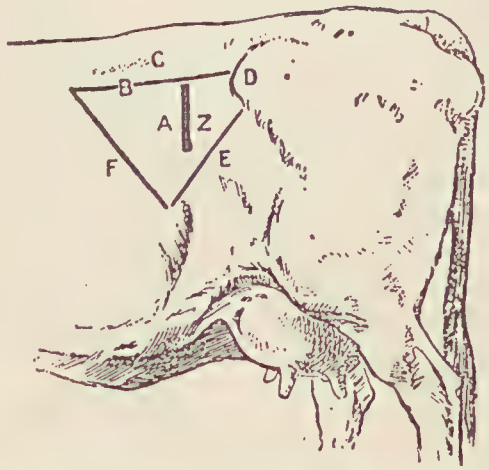


Diagram showing the site for the spaying operation. F, last rib; D, hip bone; Z, line of incision; B, C, and E, muscle fibres; the area A consists of abdominal muscles.

THE FLANK OPERATION

All instruments should be sterilized in boiling water for ten minutes prior to use. When not in use they should be kept in a solution containing 5 per cent. Lysol, Dettol, or some similar antiseptic.

The operator's hands must be thoroughly cleansed by scrubbing with soap in an antiseptic solution containing any of the preparations mentioned above at a strength of 1 per cent. Between operations the hands should again be cleansed in the solution.

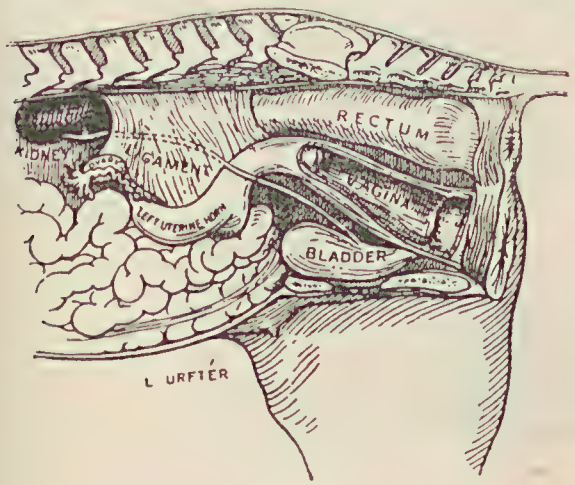
The flank method is probably the easiest and the most commonly followed by laymen. The animal should be placed in a crush. On some properties crushes have been specially built for spaying. The main objective is to keep the animal as still as possible while leaving the place of operation easily accessible. As it is essential that the animal should be in a standing position, rails should be placed under her to prevent her lying down. On the gate side (if only one gate is used) there should be a small trap-door through which the operator may work. The operation can be performed on either the left or right side, but for several anatomical reasons it is preferable that it be done on the left side.

The site for the operation is in the abdominal wall between the last rib and the point of the hip (see diagram). It is preferable to clip the hair and the area should be thoroughly washed with antiseptic solution, dried with clean cotton wool and painted with either methylated spirits or with tincture of iodine.

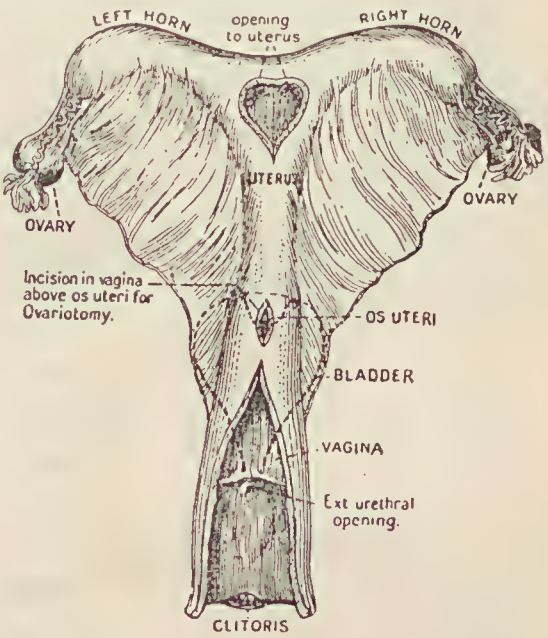
An incision is then made, usually 3½ to 4 inches long, in a downward direction. The skin having been cut through, the fibres of the outer muscle are exposed; these can then be divided with the knife or the fingers. When the muscle has been divided, the fibres of the next muscle running in an opposite direction are likewise divided.

The peritoneum or lining of the abdomen or bowel cavity is now revealed and when divided shows in the opening the rumen or first stomach wall. The peritoneum can be recognized by its shining appearance. The hand is then inserted and the right ovary (if operation is on the left side) is sought. The ovaries are usually oval shaped and vary in size with the age of the animal. In calves they are about the size of a pea; in two-year-old heifers about the size of a broad bean, while in old cows they may be as large as a bantam's egg. Should an ovary be cystic it will be larger than normal, and may be greatly enlarged if diseased. From the illustration it will be seen that one ovary is attached to the right horn of the uterus and the other to the left horn.

When the operator has grasped an ovary with one hand the emasculator should be inserted with the other hand and the ovary carefully removed. The remaining ovary is then similarly removed. The incision is then sutured (stitched) with several strong stitches which should be interrupted, i.e., each stitch should be separate. Sometimes a continuous thread is used, as when bags are being sown; this should not be done. The stitches should be dressed with collodion, or if a cheap dressing is required, Stockholm tar may be used. No further treatment is required, except the removal of the stitches when the wound heals.



Showing the position of the genital organs.



The vagina, uterus and ovaries.

THE VAGINAL OPERATION

This method has many advantages and is the one almost always adopted by veterinarians when operating on adult cattle.

If no crush is available an ordinary bail is quite satisfactory and is all that is required for dairy cows.

The equipment already mentioned is all that is necessary except for the addition of a special spaying knife having a concealed blade, which is not opened till in the vagina just prior to the incision being made. (The suture material, such as needles, silk, methylated spirit, &c., will not be required.)

Cows, especially dairy cows, should be first examined to ascertain if there is any abnormality such as a discharge from the uterus or from the vulva, or any signs of vaginitis. If all is apparently normal the vagina should not be washed out, but the

anus, vulva and buttocks should be well cleansed with a 5 per cent. antiseptic solution as recommended for the disinfection of instruments.

The hands having been thoroughly cleansed, the operator should insert a hand into the vagina with the special knife concealed in the palm. Two or three inches above the mouth of the womb an incision about an inch long should be made through the vaginal wall and also through the peritoneum, as otherwise the ovaries cannot be reached. After the knife has been removed from the vagina the fingers should be inserted through the wound opening to feel for an ovary; the ovary is generally withdrawn through the opening, and removed, the emasculator having been inserted by the other hand. The ovary is left on the floor of the vagina while the other ovary is located and removed in the same way. The emasculator, both ovaries and the hand are then withdrawn and the operation is complete. Normally, no further dressing or attention is necessary except that the animal should be kept as quiet as possible for a few days.

With keen attention to detail, such as cleanliness and the avoidance of any attempt at undue speed in operating, losses as a result of spaying can be reduced to a minimum.

General Instructions

At the time of the operation the animal's bowels should be as empty as possible.

Spay only when the animals are cool.

Yards and surroundings should be free from dust.

Sterilize instruments thoroughly.

Keep hands and arms clean and wear clean overalls.

Keep spayed cows at rest for ten days after operation.

THE VEGETABLE GARDEN—*(continued from page 517).*

beetle or other chewing insects are present. DDT is said to injure cucurbits, but sucking insects like aphis and jassids can be controlled by nicotine sprays.

Bean crops should be carefully watched for the presence of red spider on the undersides of the leaves. Preparations containing H E T P gave good control last year. Lime-sulphur sprays or sulphur dusts which have been used satisfactorily for many years, are probably the best to use when the plants are podding, as H E T P residue may be toxic to human beings if consumed. All summer vegetable crops will benefit by fortnightly waterings of dilute liquid manure applied after a good watering, around, but not over the plants.

ASSOCIATION HERD TEST—*(continued from page 490).*

Herds of Less Than 20 Cows.

Owner.	Association.	Cows.	Butterfat.
Hec. McLean ..	Leongatha ..	18	502
R. J. Connor ..	Milawa ..	10	475
P. A. Freestone ..	North Murchison No. 1	14	429
F. W. Fulford ..	Bairnsdale No. 2	14	404
S. Montgomery ..	Nathalia No. 1	11	396
H. Van Der Sloot	Bairnsdale No. 2	13	391
J. B. French ..	Swan Hill ..	14	384
D. G. Christie ..	Echuca-Village	19	373
C. V. Moore ..	Winchelsea ..	17	372
R. J. Wells ..	North Murchi- No. 1	9	372
G. F. Wade ..	Merrigum No. 2	17	370
Mrs. A. M. Wood	Pakenham ..	16	367
E. J. Ryrie ..	Ballarat No. 2	15	365
J. J. Wilson ..	Toora-Welshpool	14	362
C. Serpell ..	Swan Hill ..	16	360
H. T. Lumsden ..	Warragul No. 2	17	357
I. Hobbs ..	Phillip Island	18	354
R. D. Dessent ..	Yarram ..	14	354
A. S. Chalmers ..	Yarra Valley	19	352
D. Smith ..	Ballarat No. 2	13	352
A. E. Charlton ..	Stony Creek ..	17	351
W. Pilgrim ..	Bairnsdale No. 3	18	349
Lyell Ludeman ..	Ecklin South	19	346
A. J. Stewart ..	Milawa ..	19	346
Mrs. C. I. Pool ..	Bairnsdale No. 2	8	342

Herds of 20 to 39 Cows.

P. Taylor ..	Rochester West	34	451
Ken McLean ..	Leongatha No. 1	21	447
E. Jeffries ..	Kongwak ..	23	445
H. Burgman ..	Katandra West	35	444
H. W. Wood ..	Winchelsea ..	27	439
F. J. Dinneen ..	Toora-Welshpool	28	433
R. J. Hansford ..	Traralgon No. 2	25	425
T. A. Dickie ..	Katandra West	24	425
Mrs. B. Malone ..	Winchelsea ..	21	424
T. Gaw ..	Bass No. 1 ..	26	418
L. Oliver ..	Rochester West	36	415
N. L. Pratt ..	Warragul No. 2	31	413
Mrs. E. A. Pratt	Warragul No. 2	31	410
R. Allott ..	Toora-Welshpool	24	410
R. Coleman ..	Maffra-Sale No. 3	31	409
C. Wade ..	Camperdown ..	33	407
H. S. Woodman	Rochester East	28	406
G. McBayliss ..	Pyramid-Calivil No. 1	37	403
J. V. Barrow ..	Korumburra No. 3	36	403
F. G. Williams ..	Tongala No. 1	20	403
W. R. Bjorksten	Toora-Welshpool	32	402
S. Miles ..	Bass No. 1 ..	33	401
F. Woodbury ..	Swanpool No. 2	23	400
G. B. Haines ..	Rochester West	35	398
H. Kay ..	Swan Hill ..	32	398
C. and L. Winchcomb	Rochester East	36	394
H. Oliver ..	Rochester West	29	394
Mrs. E. L. Heath	Camperdown ..	27	394
R. E. Baersch ..	Winchelsea ..	33	393
F. A. Crooke ..	Merrigum No. 1	33	393
Thos. Gilmore and Son	Pyramid-Calivil No. 2	22	392
O. Martin ..	Traralgon No. 3	26	391

Herds of 20 to 39 Cows—*continued.*

Owner.	Association.	Cows.	Butterfat.
R. A. Seabrook ..	Korumburra No. 1	39	378
M. K. Orgill ..	Swan Hill ..	26	378
R. Dinsdale ..	Rochester West	34	375
F. S. Davisdon ..	Bairnsdale No. 4	23	374
T. Bott ..	Kerang No. 3	34	372
C. L. Prigg ..	Rochester East	24	370
W. R. Orr ..	Merrigum No. 2	30	369
T. J. Anderson ..	Merrigum No. 1	22	369
G. B. Harrison ..	Dumbalk No. 1	39	368
C. A. Bunn ..	Merrigum No. 2	28	368
R. Maskell ..	Cobden ..	33	367
H. Humbert ..	Pyramid-Calivil No. 1	33	366
J. Jones ..	Korumburra No. 4	26	365
L. Howes ..	Tongala No. 1	35	364
P. Glasson ..	Rochester West	34	362
T. Dewhurst ..	Katandra West	37	362
T. H. Fowles ..	Korumburra No. 1	33	362
O. T. Jones ..	Dumbalk North No. 1	24	362
J. H. Cottrell ..	Toora-Welshpool	22	362
J. L. De Soyres ..	Kyabram No. 2	33	358
J. D. Pierce and Son	Rochester East	33	357
J. V. Ferguson ..	Swan Hill ..	24	357
T. Alcorn ..	Merrigum No. 1	34	356
J. R. Trump ..	Korumburra No. 3	32	356
J. G. Findlay ..	Upper Murray No. 2	37	355
R. Cunningham ..	Rochester West	23	355
F. L. Maslen ..	Jindivick-Neerim	25	355
P. J. A. Moore ..	Merrigum No. 2	30	354
G. A. Brown ..	Stanhope No. 1	34	353
F. C. Motton ..	Lenogatha No. 2	38	352
K. Kenny ..	Narracan No. 2	21	351
A. Cormican ..	Katandra West	32	350
I. C. Benn ..	Dumbalk No. 2	27	350

Herds not included in last year's list.

R. Coleman ..	Maffra-Sale No. 3	36	391
R. Rautman ..	Maffra-Sale No. No. 1	29	348
J. Hotchkiss ..	Maffra-Sale No. 1	24	347

Herds of 40 to 59 Cows.

C. W. Smith ..	Rochester West	56	443
A. Walker ..	Yinnar ..	45	430
J. McNicol ..	Tongala No. 2	40	418
Harrison Bros. ..	Korumburra No. 4	41	409
J. S. Bullingham	Tongala No. 1	47	405
Mrs. M. A. Park	Tallangatta No. 1	59	405
J. A. Warnock ..	Swan Pool No. 1	43	402
J. G. Howell ..	Leongatha No. 2	59	398
V. Free ..	Leitchville No. 1	40	393
W. A. Wood ..	Tallangatta No. 1	47	388
J. Martin ..	Stanhope No. 1	44	388

HERDS OF 40 TO 59 COWS—*continued.*

Owner.	Association.	Cows.	Butterfat.
K. W. Holmes ..	Traralgon No. 4	53	385
W. Brennan ..	Swan Pool No. 1	42	385
L. S. and A. L. Hunt	Merrigum No. 2	41	385
H. E. Furphy and Son	Dumbalk No. 2	47	382
L. O. V. Bunn ..	Korumburra No. 3	46	380
J. D. Crothers and Son	Merrigum No. 1	41	376
J. M. Lyle ..	Undera ..	51	373
S. Fuller ..	Tongala No. 2	48	370
S. M. Linford ..	Stanhope No. 1	42	369
F. B. Tonkin ..	Undera ..	59	368
E. J. Hicks and Son	Rochester West	43	368
M. Purton ..	Kerang No. 2	41	366
H. J. Clark ..	Kyabram No. 1	54	365
S. Miles ..	Korumburra No. 2	44	365
Killmartin Brothers	Merrigum No. 1	56	362
R. B. Metherall ..	Stony Creek ..	45	361
S. A. Phillips ..	Katandra West	44	360
P. Hildebrand ..	Leitchville No. 2	54	359
A. J. Gibbs and Son	Kyabram No. 1	52	358
E. Hollingworth ..	Kerang No. 2	56	357
Chas. Walker ..	Yinnar ..	46	357
A. Cowie and Sons	Stanhope No. 1	42	357
N. Kuhne ..	Leongatha No. 2	40	357
B. Trease ..	Dumbalk North No. 1	56	356
C. C. Nethercote and Son	Kerang No. 1	57	355
Chisholm and Ford	Swan Hill ..	40	355
H. Wallden ..	Katandra West	44	355
A. E. Tack ..	Korumburra No. 2 ..	41	354
C. Tudor ..	Yarram ..	49	354
R. Kennaugh ..	Echuca-Village	44	353
N. M. Tapp No. 2	Camperdown ..	52	352
Syd. R. Tudor ..	Yarram ..	58	350
E. Clark ..	Tongala No. 1	51	350
D. E. Fehring ..	Rochester West	51	350
A. E. Bellingham	Leongatha No. 1	42	350

HERDS OF 60 TO 79 COWS.

Northey and Co.	Bethanga ..	66	383
F. J. Olden ..	Korumburra No. 2	61	383
G. Millard ..	Kongwak ..	61	378
Mrs. M. P. Smith	Rochester West	60	372
J. R. Nichol ..	Tallangatta No. 1	66	369
D. and G. Dodd..	Dumbalk-North No. 1	71	370
L. J. Affleck ..	Traralgon No. 1	79	368
R. Farragher and Son	Woodford No. 1	64	366
W. Dyke ..	Dumbalk No. 1	63	366
G. R. Jones ..	Warragul No. 1	65	360
R. H. and J. L. Trease	Dumbalk North No. 1	77	356
W. J. Miles ..	Bass No. 1 ..	64	355

HERDS OF 60 TO 79 COWS—*continued.*

Owner.	Association.	Cows.	Butterfat.
Neil McKimmie ..	Upper Murray No. 2	60	353
J. A. McKinnon and Sons	Port Campbell No. 1	65	352
N. J. and O. Thompson	Traralgon No. 4	63	347
J. A. McKinnon and Sons	Timboon No. 1	70	340
H. E. Hicks ..	Stanhope No. 1	61	339
Truskott Brothers	Toora-Welshpool	67	336
L. Coverdale ..	Cobden ..	63	336
N. M. Tapp ..	Camperdown ..	61	334
F. McKenzie ..	Fish Creek ..	66	334
Mrs. B. MacIlroy	Moyhu ..	71	329
J. Lees ..	Toora-Welshpool	65	328
C. J. Hill ..	Korumburra No. 1	71	326
Mathers Brothers	Cohuna ..	76	325
M. Cowie ..	Maffra-Sale No. 3	67	325
Geo. Cardwell ..	Tallangatta ..	67	324
C. A. Schier ..	Cohuna ..	70	320
J. Behrens and Son	Leitchville No. 2	77	319
Gall Brothers ..	Warrnambool No. 1	74	317
J. Meikle ..	Stony Creek ..	64	316
Jas. Connihan ..	Bairnsdale No. 1	67	315
J. and R. Gilbert	Yinnar ..	76	314
J. Bell and Sons	Stanhope No. 1	60	314

HERDS OF 80 OR MORE COWS.

G. Harrison ..	Dumbalk North No. 1	80	368
R. T. Harrison ..	Dumbalk No. 1	81	357
Mrs. A. Crosthwaite	Kiewa Valley No. 2	85	354
A. J. Menzies ..	Leongatha No. 1	103	338
E. W. York ..	Dumbalk North No. 1	80	338
Meadowcroft Brothers	Stanhope No. 1	80	327
K. F. Zegelin ..	Rochester East	112	325
A. Ashendon ..	Dumbalk No. 1	88	309
E. M. Bourne ..	Korumburra No. 1	110	302
A. Zegelin and M. Chirnside	Rochester West	121	298
C. D. Crosthwaite	Kiewa Valley No. 2	93	293
Parsons and Klitzing	Leongatha No. 1	93	293
M. P. Williams ..	Narracan No. 1	82	287
H. and H. Harris	Upper Murray No. 1	81	286
J. Moore and Co. No. 3	Yarram ..	154	284
J. A. Marshall and Sons	Bairnsdale No. 4	99	271
A. T. Gunter ..	Stanhope No. 1	88	271
S. A. Turner ..	Kiewa Valley No. 2	86	262
J. Moore and Co. No. 2	Yarram ..	149	262

HERDS OF 80 OR MORE COWS—*continued.*

Owner.	Association.	Cows.	Butterfat.
Mrs. McSweeney	Yarram ..	134	259
A. and N. and C. McNamara	Upper Murray No. 1	82	256
J. Gosborn ..	Maffra-Sale No. 1	97	250
J. A. Ford ..	Kiewa Valley No. 2 ..	117	249
Est. W. Connihan	Bairnsdale No. 1	86	249
S. E. Rowe ..	Leongatha No. 1	85	246

HERDS OF 80 OR MORE COWS—*continued.*

Owner.	Association.	Cows.	Butterfat.
A. Foster ..	Maffra-Sale No. 1	88	245
J. Moore and Co. No. 7	Yarram ..	114	244
R. J. O'Donnell and Son	Coleraine ..	97	244
Mrs. E. Smith ..	Rochester East	85	243
H. Woodruff ..	Paschendale No. 2	82	243
J. N. Glass ..	Rochester East	89	237

BEST TWO-YEAR-OLDS

Owner.	Association.	Cow's Name.	Milk.	Butterfat.
			lb.	lb.
Walter Miles	Pyramid-Calivil No. 2..	Darky	8,713	612
J. S. Bullingham	Tongala No. 1 ..	Mary	15,186	555
J. S. Bullingham	Tongala No. 1 ..	Eva III.	9,540	552
P. Taylor	Rochester West ..	Lucy	10,428	541
W. E. Dyke	Dumbalk No. 1 ..	Myrtle	7,734	534
H. Oliver	Rochester West ..	Beauty	8,861	531
T. Gaw	Bass No. 1	H 19	9,239	530
K. Grant	Warragul No. 2 ..	Amy	11,411	521
J. V. Ferguson	Swan Hill	Surrey Buttercup 31st	9,444	514
L. Tudor	Yarram	Peggy	9,144	507
F. B. Tonkin	Undera	149	9,036	500
R. J. Hirst	Heytesbury	Curdie's Fancy Belle ..	8,411	500
Thos. Gilmore and Sons ..	Pyramid-Calivil No. 2..	Ingolston Mac ..	10,668	487
P. Taylor	Rochester West ..	Rose Marie 2nd ..	10,180	482
C. W. Smith	Rochester West ..	Eve	9,102	473
W. E. Dyke	Dumbalk No. 1 ..	Phil	8,174	468
E. Hollingworth	Kerang No. 2 ..	Pip	8,846	468
P. Glasson	Rochester West ..	Topsy	7,728	467
J. G. Howell	Leongatha No. 2 ..	Baldy	7,047	465
E. Clark	Tongala No. 1 ..	Bonny	10,535	461
J. Moore and Co. No. 3 ..	Yarram	Fairy	8,182	461

BEST 20 THREE-YEAR-OLDS

Owner.	Association.	Cow's Name.	Milk.	Butterfat.
			lb.	lb.
C. W. Smith	Rochester West ..	Margaret	11,313	642
Hec. McLean	Leongatha No. 1 ..	Denbigh Beatrice ..	9,273	608
Mrs. B. MacIlroy	Moyhu	Melba	7,637	605
P. Taylor	Rochester West ..	Linda	12,108	595
A. Walker	Yinnar	Fairy 5th	9,452	571
P. Taylor	Rochester West ..	Glenda	10,456	567
E. Jeffries	Kongwak	Duke's Do Do ..	8,179	552
P. M. Kerrins	North Murchison No. 2	Paney	11,251	548
F. B. Tonkin	Undera	122	8,562	548
G. B. Haines	Rochester West ..	Irene	9,888	547
J. C. McNicol	Tongala No. 2 ..	Crow	9,060	543
F. Woodbury	Swanpool No. 2 ..	Nora	11,661	541
F. S. Davidson	Bairnsdale No. 4 ..	Balladale Rosette ..	9,750	541
C. and L. Winchcomb ..	Rochester East ..	Sally	9,414	541
K. Grant	Warragul No. 2 ..	Susie	10,078	538
L. Oliver	Rochester West ..	Primrose	9,144	538
C. W. Smith	Rochester West ..	Gem	10,022	536
Estate Late J. A. Chapman ..	Merrigum No. 1 ..	Bambi	7,868	536
L. Oliver	Rochester West ..	Silvie	9,302	535
A. Walker	Yinnar	Queenie 2nd	8,496	532

BEST 20 FOUR-YEAR-OLDS

Owner.	Association.	Cow's Name.	Milk.	Butterfat.
			lb.	lb.
H. E. Furphy and Son	Dumbalk No. 2	Rita	9,681	670
L. J. Affleck	Traralgon No. 1	Goldie II.	10,571	654
L. S. and A. L. Hunt	Merrigum No. 2	Nancy	9,178	603
C. W. Smith	Rochester West	Cookie	9,266	575
F. G. Howell	Leongatha No. 2	Stumpy	8,988	570
P. A. Freestone	North Murchison No. 1	Netta	8,895	568
E. Jeffries	Kongwak	Ladylike	8,663	559
Hec. McLean	Leongatha No. 1	Denbigh Minnie	10,405	557
G. R. Jones	Warragul No. 1	Kitty	9,144	557
H. E. Furphy and Son	Dumbalk No. 2	Brownie	9,365	556
J. Moore and Co. No. 2	Yarram	Dainty	9,356	553
J. Humbert	Pyramid-Calivil No. 1	Baby	8,919	551
F. C. Motton	Leongatha No. 2	Sally	8,831	547
H. Kay	Swan Hill	Carnation	8,463	545
R. J. Connor	Milawa	Downside Dawn	10,540	544
F. A. Crooke	Merrigum No. 1	Kate	8,782	544
J. Martin	Stanhope No. 1	Belle	9,267	542
J. S. Bullingham	Tongala No. 1	Marie	15,316	541
C. W. Ludeman	Nirranda No. 1	Toby	9,737	541
G. Millard	Kongwak	Thelma	10,771	539

ASSOCIATIONS GROUPED ACCORDING TO AREA AND PRODUCTION

Association.	Number of Herds.	Number of Cows.	Number of Junior Cows Under Three Years.	Number of Pure Bulls.	Average Butterfat Per Cow.
					lb.
GIPPSLAND.					
Dumbalk North No. 1	22	1,008	214	30	305
Toora-Welshpool	25	915	253	21	286
Yinnar	23	1,100	253	25	283
Leongatha No. 1	22	1,092	279	29	282
Warragul No. 1	22	726	186	21	281
Leongatha No. 2	19	654	171	34	281
Dumbalk No. 1	18	839	180	13	279
Kongwak	25	942	258	28	278
Korumburra No. 3	27	1,016	257	37	278
Korumburra No. 1	26	1,148	285	42	276
Stony Creek	25	951	235	25	275
Maffra-Sale No. 2	19	611	133	29	275
Korumburra No. 2	24	923	197	34	274
Maffra-Sale No. 3	22	839	217	24	273
Korumburra No. 4	24	867	174	24	272
Dumbalk No. 2	22	859	220	22	271
Bass	22	790	196	37	269
Leongatha No. 3	25	710	203	25	268
Narracan No. 3	24	695	147	25	266
Warragul No. 2	22	777	208	33	266
Bairnsdale No. 3	25	785	180	24	265
Yarram	25	1,516	474	30	263
Traralgon No. 3	24	1,018	254	27	260
Fish Creek	21	922	260	..	260
Toora	26	797	157	18	259
Maffra-Sale No. 1	20	910	228	28	259
Jindivick-Neerim	25	734	180	26	258
Boolarra	30	869	219	34	251
Traralgon No. 4	25	925	232	..	250

Association.	Number of Herds.	Number of Cows.	Number of Junior Cows Under Three Years.	Number of Pure Bulls.	Average Butterfat Per Cow.
					lb.
GIPPSLAND—*continued.*					
Bairnsdale No. 4	17	827	184	22	250
Foster No. 2	18	482	107	16	249
Narracan No. 1	23	835	159	18	246
Bairnsdale No. 2	19	481	116	12	241
Traralgon No. 2	31	1,068	259	26	240
Pakenham	22	781	230	34	237
Traralgon No. 1	25	1,392	384	25	235
Narracan No. 2	18	432	116	26	230
Foster No. 1	21	709	146	15	229
Lang Lang	20	624	130	26	223
Yarra Valley	24	321	75	14	218
Buchan and Nowa Nowa	17	493	112	10	218
Bairnsdale No. 1	23	820	179	22	217
Phillip Island	24	726	167	27	203
Orbost No. 1	19	1,195	258	28	175
WESTERN.					
Camperdown	21	792	178	31	301
Winchelsea No. 1	24	562	135	24	283
Ballarat No. 2	24	452	114	21	250
Port Fairy No. 1	22	916	181	12	250
Cobden No. 1	26	1,011	272	..	248
Warrnambool No. 1	20	987	262	39	246
Port Campbell No. 1	25	1,069	245	26	244
Heytesbury	24	668	162	..	244
Timboon No. 1	26	924	196	23	243
Ecklin South	25	879	229	36	242
Macarthur	33	1,083	247	24	232
Apsley	10	323	79	16	231
Ballarat No. 1	26	550	125	33	228
Apollo Bay	25	824	183	24	226
Woodford No. 1	23	1,159	229	24	224
Casterton	24	755	160	25	223
Cobden No. 2	26	937	247	29	222
Paschendale No. 2	17	959	99	23	221
Portland	34	1,211	196	29	219
Nirranda No. 1	23	938	281	5	219
Nirranda No. 2	24	1,082	262	20	216
Paschendale No. 1	21	1,058	191	26	215
Pomborneit No. 1	21	776	270	27	211
Noorat	23	1,343	282	28	210
Woodford No. 2	18	702	175	8	210
Warrnambool No. 2	19	1,019	243	22	209
Irrewillipe	22	678	176	20	195
Warrnambool No. 3	20	612	153	20	187
Coleraine	23	915	199	23	186
GOULBURN VALLEY.					
Rochester West	23	1,111	318	29	338
Stanhope No. 1	22	968	225	22	312
Katandra West	26	899	227	26	302
Tongala No. 1	21	903	279	36	301
Merrigum No. 1	26	1,019	238	24	298
Tongala No. 2	21	942	218	39	295
Swan Hill	26	779	175	39	293
Cohuna No. 1	23	1,092	249	32	290
Merrigum No. 2	26	884	233	29	285
Leitchville No. 2	24	1,049	261	34	285
Rochester East	22	977	249	22	283

Association.	Number of Herds.	Number of Cows.	Number of Junior Cows Under Three Years.	Number of Pure Bulls.	Average Butterfat Per Cow.
					lb.
GOULBURN VALLEY—*continued.*					
Undera	26	969	217	30	280
Pyramid-Calivil No. 1	22	828	211	20	279
Leitchville No. 1	24	1,020	223	28	278
Kyabram No. 1	25	1,074	291	..	270
Kerang No. 2	24	940	292	25	268
Kerang No. 1	24	824	210	29	255
Nathalia	22	512	115	..	253
Echuca-Village	24	766	206	26	249
Gunbower	24	749	192	11	249
Cobram	25	584	223	24	248
North Murchison No. 1	26	891	241	19	244
Pyramid-Calivil No. 2	24	655	88	19	244
Cohuna No. 2	44	884	206	18	243 Testing ceased from 31.1.49
Kyabram No. 2	25	791	227	36	240
North Murchison No. 2	27	862	223	26	239
Kerang No. 3	22	485	109	23	225
NORTH-EASTERN.					
Swanpool No. 1	25	855	213	28	291
Tallangatta	19	953	222	29	283
Upper Murray No. 2	21	963	254	41	265
Kiewa Valley No. 2	19	1,211	283	23	260
Milawa	24	712	167	20	257
Moyhu	26	848	264	29	251
Swanpool No. 2	24	710	225	23	250
Bethanga	24	1,033	258	24	244
Myrtleford-Whorouly No. 2	13	533	142	11	232
Myrtleford-Whorouly No. 1	21	969	247	27	226
Upper Murray No. 1	20	961	215	19	224
Yea	22	874	184	17	223
Euroa	21	331	67	10	221
Alexandra	22	713	166	..	220
Rutherglen-Chiltern	24	883	215	19	215
Kiewa Valley No. 1	15	153	37	11	200

LEADING MATURE COWS WHICH PRODUCED OVER 600 LB. BUTTERFAT

Owner.	Association.	Cow's Name.	Milk.	Butterfat.
			lb.	lb.
W. E. Dyke	Dumbalk No. 1 ..	Beauty	11,823	918
M. Drane	Traralgon No. 3 ..	Glenloth Mavis ..	18,890	857
R. T. Harrison	Dumbalk No. 1 ..	Champion	10,758	724
H. Kelly	Korumburra No. 4 ..	Beryl	11,355	710
L. S. and A. L. Hunt ..	Merrigum No. 2 ..	Bonnie	13,164	707
Est. W. Connihan	Bairnsdale No. 1 ..	Mottley	11,100	706
J. H. McKinnon and Sons ..	Timboon No. 1 ..	Ellinure Nola's Fancy	13,996	701
North and Spedding	Leitchville No. 1 ..	Smokey	8,814	698
Thos. Gilmore and Son ..	Pyramid Calivil No. 2	Ingolston Superior ..	11,256	697
J. S. Bullingham	Tongala No. 1 ..	Mary Lou	14,796	687
N. L. Pratt	Warragul No. 2 ..	Pet	11,050	685
F. J. Dinneen	Toora-Welshpool ..	Scarlett	11,747	678

LEADING MATURE COWS WHICH PRODUCED OVER 600 LB. BUTTERFAT.—*continued.*

Owner.	Association.	Cow's Name.	Milk.	Butterfat.
			lb.	lb.
E. Jeffries	Kongwak	Jessie	10,109	676
Est. H. Gooch, No. 1 Dairy	Undera	Poppy	7,010	668
Owen T. Jones	Dumbalk North No. 1	Ronwyn Strathbow Heather	12,595	662
G. H. English	Tongala No. 1	Belle 17	11,435	656
J. M. Lyle	Undera	Elsie	12,235	654
W. R. Bjorksten	Toora-Welshpool	Ann	11,386	645
Gall Brothers	Warrnambool No. 1	Fussy	11,255	645
C. W. Smith	Rochester West	Pearl	10,629	643
C. H. Becher	Toora-Welshpool	Gwen	10,763	642
A. Walker	Yinnar	Polly	10,796	640
Northey and Co.	Bethanga	Mornmoot Princess Madeira 26th	13,401	637
J. G. Howell	Leongatha No. 2	Rose	10,406	635
F. J. Dinneen	Toora-Welshpool	Gertie	11,246	634
G. and F. Brady	Traralgon No. 4	Bluey	10,675	631
C. A. Bunn	Merrigum No. 2	Maneroo Sunspot	11,258	628
O. S. Martin	Traralgon No. 3	Cairnbrook Fancy 2	9,380	628
J. H. McKinnon and Son	Port Campbell No. 1	Ellinure Priscilla	11,325	627
F. J. Dinneen	Toora-Welshpool	Dina	10,194	625
T. A. Dickie	Katandra West	Tilly Glen Urquhart	12,689	624
K. Grant	Warragul No. 2	Dandy Princess	10,955	624
N. L. Pratt	Warragul No. 2	Ruby	12,525	622
A. Walker	Yinnar	Iris 4	9,841	620
F. McKenzie	Fish Creek	Molly	10,678	619
A. H. Barrett	Merrigum	Darkie	12,044	618
Thos. Gilmore and Son	Pyramid-Calivil No. 2	Ingolston Merlin	9,866	616
W. Brennan	Swanpool	Peggy	11,160	615
G. Millard	Kongwak	Brindle	11,143	614
Est. of Late W. R. Brisbane	Camperdown	Dream	11,460	613
H. Oliver	Rochester West	Heather 2	12,181	612
F. B. Tonkin	Undera	90	15,611	611
R. Allott	Toora-Welshpool	Joyce	11,221	611
A. H. Richards	Dumbalk No. 2	Megs	8,402	611
Hec. McLean	Leongatha No. 1	Clonmore Duchess 2	12,509	608
Mrs. E. L. Heath and Son	Camperdown	Iona	8,255	607
Kilmartin Brothers	Merrigum	Trixie	12,072	606
Mrs. A. C. Crosthwaite	Kiewa Valley No. 2	Rose 3	9,385	606
Mrs. A. C. Crosthwaite	Kiewa Valley No. 2	Poppy	10,552	605
J. Kilpatrick and Co.	Korumburra No. 4	Model	13,081	603
P. J. A. Moore	Merrigum No. 2	Twinkle	12,269	602
Hec. McLean	Leongatha No. 1	Denbigh Lolo	10,938	601
M. J. Williams and Sons	Gunbower	Darkie	10,832	601
O. S. Martin	Traralgon No. 3	Fleck	10,674	600
J. R. Trump	Korumburra No. 3	Launton Belle 4	9,430	600

Margaret, the leading three-year-old this year, produced 642 lb. butterfat. Margaret is owned by Mr. C. W. Smith, Rochester West Association.

SUMMARY OF ASSOCIATION HERD TEST DATA FOR YEAR ENDED 30TH JUNE, 1949

Area.	Units.	Herds.	Cows Tested.	Junior Cows Under 5 Years of Age.		Pure Bred Bulls.		Average Number of Cows in Herd.	Average Yield per Cow.		
				Juniors.	Per-centage.	Bulls.	Per-centage.		Milk.	Test.	Butter-fat.
									lb.	+	lb.
Goulburn Valley	27	646	23,404	14,357	61·3	698	108·0	36·2	5,973	4·61	275
Gippsland ..	44	1,000	36,999	20,784	56·1	1,100	110·0	36·9	5,189	4·97	258
North Eastern ..	16	340	12,619	7,439	58·9	353	103·0	37·1	4,967	4·94	245
Western ..	29	668	25,186	13,567	53·9	697	104·3	37·6	4,869	4·67	228
Total 1948–49	116	2,654	98,208	56,147	57·1	2,848	107·3	37·0	5,265	4·80	253

NOTE.—Details not yet to hand from Archie's Creek, Bacchus Marsh, Henty, Loch and Winslow Associations.

HERD TEST DATA FOR PERIOD 1928–1948

Area	Units.	Herds.	Cows Tested	Junior Cows Under 5 Years of Age.		Pure Bred Bulls.		Average Number of Cows in Herd.	Average Yield per Cow.		
				Juniors.	Per-centage.	Bulls.	Per-centage.		Milk.	Test.	Butter-fat.
									lb.		lb.
1947–48 ..	98	2,327	86,276	48,855	56·6	2,196	94·4	37·1	5,218	4·82	252·0
1946–47 ..	93	2,160	79,303	18,264	23·0*	2,128	98·3	37·0	5,411	4·88	264·0
1945–46 ..	72	1,705	61,738	13,477	22·0*	1,623	95·0	36·0	5,043	4·73	239·0
1944–45 ..	59	1,415	53,015	22,396	42·0	1,320	93·0	38·0	4,654	4·68	218·0
1943–44 ..	31	782	27,346	14,988	54·0	805	103·0	35·0	4,740	4·70	223·0
1942–43 ..	25	623	22,154	(Details affected by war conditions)				35·0	4,959	4·70	237·0
1941–42 ..	40	946	34,218	,,	,,	,,	,,	36·0	4,960	4·74	235·0
1940–41 ..	70	1,645	60,018	25,988	42·6	1,390	85·0	36·0	5,200	4·70	245·0
1939–40 ..	101	2,346	84,690	34,723	41·2	2,004	85·0	36·0	5,450	4·79	261·0
1938–39 ..	100	2,275	79,805	34,248	42·9	1,904	83·6	35·0	4,749	4·70	221·0
1937–38 ..	104	2,410	86,048	37,467	43·5	1,969	83·0	36·0	4,876	4·70	227·0
1936–37 ..	107	2,350	80,528	36,106	45·0	1,874	81·0	34·3	5,076	4·80	244·0
1935–36 ..	108	2,416	80,817	37,817	47·0	1,946	81·0	33·0	4,934	4·70	233·0
1934–35 ..	113	2,446	79,701	36,116	45·3	1,991	81·4	32·6	5,309	4·59	244·0
1933–34 ..	134	2,910	92,953	43,394	46·0	2,214	76·0	31·7	4,723	4·51	212·0
1932–33 ..	141	3,383	104,009	46,392	44·6	2,619	77·0	31·0	5,290	4·55	241·1
1931–32 ..	130	3,098	89,619	36,946	41·3	2,323	75·6	29·0	5,393	4·58	247·3
1930–31 ..	132	3,085	90,360	32,867	36·4	2,251	73·0	29·0	5,383	4·30	234·0
1929–30 ..	116	2,604	76,032	24,439	32·1†	1,653	71·0	29·0	5,044	4·46	226·1
1928–29 ..	96	2,229	63,277	19,246	30·4†	1,354	64·0	30·0	5,080	4·38	223·3

* Denotes junior cows under 3 years of age. † Denotes junior cows under 4 years of age.

Messrs. Northey & Co's Mornmoot Princess Madeira 26th gave a mature yield of 637 lb. butterfat.

Citrus Growing in California

Observations made by Frank M. Read, M.Agr.Sc., Chief Inspector of Horticulture, during a visit last year to the United States of America

Fumigating citrus trees in southern California.

Although production of citrus in the United States doubled in the ten years 1937–1947, and is still increasing, Californian production did not alter greatly in that time, and there is no indication of a prospective increase in that State. An interesting feature of the American citrus industry is the increase during the past twelve years in the percentage of the crop processed. In 1945–46 it was already 26 per cent. of the oranges, 56 per cent. of the grapefruit and 38 per cent. of the lemons. Dehydration of citrus juice may enable these figures to be exceeded and the crop disposed of more economically and farther afield.

CALIFORNIA is a mountainous State with a number of very fertile and, usually, long narrow valleys where horticulture is practised under irrigation. In the southern part of the San Joaquin Valley, which runs down the centre of the State, Navel oranges predominate, while Valencias and lemons are grown more in the counties around Los Angeles and in the valleys of Southern California extending eastward from Los Angeles through Riverside.

The Citrus Experiment Station established in 1913 at Riverside, and one of the eight campuses of the University of California, is well-known by name in Australia. It is one of the world's largest research stations for the study of sub-tropical agriculture. It has a scientific staff of upwards of 60 workers of very high calibre, the divisions of study including Biological Control of Insects, Entomology, Irrigation and Soils, Orchard Management, Plant Breeding, Plant Pathology, Plant Physiology, Soils and Plant Nutrition. In addition to the main crop studied, citrus, the work covers avocados, dates, walnuts, olives, figs, deciduous fruits, and vegetables.

Navel oranges, Exeter, San Joaquin Valley, California.

The experimental fields of the Station cover over 750 acres, and recently it has been established as a College in the University of California giving a four-year course. It has, of course, since its inception, been a centre for post-graduate work, leading to higher degrees.

Most of the groves in California are treated in a manner broadly similar to those in the irrigated districts of Victoria. We have, of course, for long followed Californian experience, and, for that reason, development has been rather similar during the past generation in both countries. Broadly, the methods of cultivation are similar to our own, except for the tendency to reduce cultivation, and on a percentage of the groves to abandon cultivation altogether. Where clean cultivation is practised, however, it now tends to be restricted to one cultivation to every two irrigations.

Of the fertilizers, nitrogen is the only one to have been proved consistently, by experiment, to increase yields and tree health, although phosphorus and potash are also used to a considerable extent because of the feeling of growers that they improve fruit quality. This, however, has not been easy to demonstrate by field experiments.

Zinc deficiency has been quite widespread, and a spray of zinc sulphate 3–4 lb. and lime or soda ash 1½–2 lb. in 100 gallons of water is standard practice. Green crops, too, are sown in the autumn and ploughed under in the spring in most groves, just as they are here.

The study of tree nutrition by injection into the trunk of about 4 litres of appropriate nutrient solutions at a pressure of 75 lb. per square inch is one method of attack used by the Riverside Station, and there was also interest in the possibility of supplying nitrogen to the trees by means of a urea spray applied to the leaves. Though some injury had been noted in certain trials, the method seemed promising, as it did also in 1948 trials at the Beltsville Research Station on apples in Maryland, and at other centres in North America.

Many of the citrus soils are quite alkaline, and there is an active interest in the study of soil amendments, gypsum, of course, being used early and also sulphur, broadcast on the surface. Acid amendments, like sulphur, are favoured to appreciably lower soil pH, but sulphur affects only the top 6 inches of soil. The use of sulphuric acid and sulphur dixoide in the irrigation water has been tried in an effort to reach the subsoil. Other experiments in this field include the injection of sulphur suspensions at depth through steel rods fitted to the hoses of a spray tank capable of maintaining a pressure of 400 lb. to the square inch.

NON-TILLAGE

About 50,000 acres of Californian citrus are not cultivated at all, and the area is increasing. Where the grove is designed for non-tillage, three broad-based furrows are placed between the rows of trees for subsequent irrigation and then the surface plant population is destroyed by spraying with "stove oil" or, as we call it, "power kerosene" of high aromatic content. On the average, 200 to 300 gallons of this spray per acre would be needed in the first couple of years at an annual cost of between £20 and £25 per acre. Thereafter weed control by the same means is comparatively simple, the cost not exceeding usually £4 to £5 per acre per annum. There has been recently an effort to reduce these costs by using cheaper weedicides, such as pentachlorphenol, to attack the easier weeds, with a combination of stove oil and pentachlorphenol for the more difficult ones. In places, stove oil must still be used for the most difficult grasses.

Non-tillage is designed to reduce soil management costs, but of equal importance it is expected to arrest the decline in soil fertility, and especially soil structure, which has often been associated with the use of clean cultivation and standard fertilizer programmes. In many places the penetration of irrigation water into soils clean-cultivated for long periods has declined, whereas where non-tillage has been adopted the rate and depth of penetration of irrigation water has usually significantly improved, despite the relatively unattractive appearance of the surface crust.

Although non-tillage has not yet been proved by precise experiment to be superior to clean cultivation, there is no doubt that, on experience to date, it is rapidly gaining adherents, and some of these adherents, whom I met, were men exceptionally well placed to judge between the two methods.

IRRIGATION

Multi-furrow surface irrigation on clean cultivated groves seemed standard practice, while on the non-tilled groves three permanent broad-based furrows are used, as stated previously.

Mr. M. M. Winslow, Administrative Assistant to Director, Citrus Experiment Station, Riverside, and M. Louis Garnier of the Agricultural Science Service, Morocco. Visitors from all countries come to Riverside Station.

Broad-based furrows permanently in position for irrigation of a grove on which non-tillage is the system of management.

In Southern California, about 40-acre inches a year of irrigation water are applied, the trees being irrigated more frequently than is our custom under somewhat similar climatic conditions. During the hotter months of the year, irrigation may be at anything from 10 to 30 day intervals, depending on the weather, and even during the winter months irrigation is given once a month.

Evidence of over and under irrigation can be seen in a minority of Californian groves, as in our own, and in view of the increasing appearance of magnesium deficiency and of iron deficiency or lime-induced chlorosis in the Murray Valley, I was interested in the observation that magnesium deficiency in California may follow leaching due to over irrigation. The term "sand drown," synonymous with magnesium deficiency, is descriptive of this cause. Again, soil moisture has been shown to play a part in iron deficiency on alkaline soils, such as predominate in Victoria. Despite 60 or 70 chemical treatments to reduce iron deficiency symptoms in the leaves, the best treatment was to reduce soil moisture almost to wilting point.

Sprinkler irrigation is widely used in the western States of U.S.A. and Canada, although not to the same extent in citrus groves as in deciduous orchards. The greatest interest seems to be in portable systems, using 2-inch aluminium pipes as laterals with larger aluminium mains. Spray outlets were almost always under 2 feet high and mostly of low trajectory designed to go under the foliage of deciduous trees. A few high-level sprinkling systems throwing water above the trees were noticed, but there seemed little current interest in this method, which we have rather tended to favour lately in Australia. The cost of such sprinkler installations works out at about £45 an acre, including the cost of pumping equipment required to operate the sprays.

Portable aluminium irrigation pipes two inches in diameter, with a low trajectory, are most common in the western states of U.S.A. and in British Columbia.

GENERAL HEALTH OF TREES

California is concerned about a reduction in the level of vigor and health in citrus trees as a whole in recent years, generally referred to as "slow decline," and the accompanying problem of small sizes in fruit.

Whereas the peak of the normal distribution curve for Valencia oranges used to occur at about the 200 to 220 count it now occurs in the 252 to 288 range. Furthermore, when citrus trees have declined in health and an attempt is made to replant citrus on the same land, considerable difficulty is experienced in growing the young plants, and most fail to grow in an economic way.

This problem of failure of replants is not confined to citrus. It occurs also in peaches in the Sacramento Valley and other parts, and coming nearer home it is a very serious problem with our own canning peaches in the Goulburn Valley, Victoria. Usually, in citrus in Victoria, however, we do not experience the problem to any great extent.

It will be understood that the failure of replanted citrus to grow in California is not due to a destruction of the soil by salt or associated problems. The land, in fact, is quite fertile if crops other than citrus are grown on it. Even plants with such a high nutritional requirement as tomatoes will do well after declined citrus trees have been removed. It is, of course possible that a relative deficiency in, perhaps,

Furrow irrigation of a clean-cultivated orange grove, Southern California.

one of the minor elements of nutrition may play a part, but a wide range of field trials has failed to give any benefit from treatment along these lines.

Left, Valencia orange 20 years old on Cleopatra mandarin stock at Riverside. Right, Valencia orange, same age, on rough lemon or Citronelle stock.

It is thought that two factors other than deficiency of nutrients could play a part. Firstly, the citrus trees may excrete into the soil substances toxic to citrus roots but not to the roots of other plants. There is no direct evidence that this occurs, but circumstantial evidence sometimes points this way. The theory of toxins is not, of course, new. It has, for a very long time, been applied as a suggested reason why the rotation of arable crops is more desirable than continuous cultivation of the one crop over a long period of years.

Secondly, undesirable soil organisms may build up over a long period under citrus, and these may adversely affect the grove in later years, and similarly young replants.

At Riverside four fungi have been fairly consistently associated with "slow decline" in the soil at depths of 18 to 36 inches, but whether they are primarily associated with the decline is not yet known. In addition, the build up of citrus nematodes is very great, and the destruction of citrus roots by the nematodes considerable. When a tree is in vigorous health it seems to produce new roots sufficiently rapidly to offset the effects of nematode damage, but this does not occur when "slow decline" commences, and finally the root system is almost completely invaded by nematodes.

Soil sterilization has been shown to restore to old citrus soil a considerable part, though not all, of its original fertility, and it is therefore, inferred that soil organisms are playing a major part in "slow decline" with major emphasis on nematodes. Successful experiments have been made with a number of soil fumigants, including ethylene dibromide, carbon bisulphide, D.D., and chloropicrin. In unfumigated old citrus soil, citrus seedlings fail to grow satisfactorily, but in the same soil after fumigation their growth was nearly as good as in new soil.

That soil fumigation can be practised commercially is evidenced by one large experiment where ethylene dibromide was applied in the irrigation water at the rate of 1 gallon per acre in each of five applications from May to September, reducing a very high nematode population to one of negligible proportions. In a few large commercial areas, carbon bisulphide as a soil fumigant is used as standard practice, and there is considerable current interest in the newer fumigant D.D.

There is also interest in the development of efficient and economical methods of application in depth. One machine designed for this purpose, though it could also inject solutions of nutrients as well, consists of a gang of three drums each 3 feet long and 22 inches in diameter. To each drum three rows of hollow pins 18 inches long are attached, and as the drums roll over the ground these pins penetrate the soil to their full length. The material to be injected is not carried in the drum but in a hopper above, and when the pins are vertical the material flows into them from the hopper. Designed by a fig grower of Fresno, this machine was of interest to research workers with quite a range of problems.

Oil sprays applied for pest control are frequently blamed for part of this "slow decline," but though sprayed leaves have been shown to be lower in dry matter than unsprayed, there is no consistent and conclusive evidence that oil sprays have a major

Parent tree of Troyer Citrange from which seeds for Californian rootstock trials have been taken.

part in determining the vigor of the trees and the quality of the fruit, although some evidence points in this direction.

Another suspected factor is "smog," the name given a combination of smoke and fog moving eastward through the citrus valleys of Southern California from Los Angeles, now one of the greatest manufacturing cities in the United States Certainly "smog" is a blemish on what would otherwise be the clear blue Californian sky, and it may significantly reduce the quality of light in the citrus areas.

ROOTSTOCKS

Most of the trees in California have, in the past, been worked on to sour orange and sweet orange. These two stocks offer a satisfactory range, the sweet orange stocks being favored on the lighter and sour orange stocks on the heavier soil types. Both give good quality fruit. The occurrence of "quick decline," a virus disease which destroys most citrus varieties worked on to sour orange, has, however, made it necessary to discontinue using this stock and the search for rootstocks, particularly for use on heavier soil types, has gained momentum.

The rough lemon rootstock, which has been so very extensively used in Australia, is, in California, as in Victoria, regarded as a stock which induces very poor quality fruit. It is also, in California, known to be susceptible to boron toxicity under conditions which permit citrus trees to be grown on other rootstocks.

The Cleopatra mandarin is regarded as a very good substitute for the sour orange rootstock on heavier soil types. It gives good production of good quality fruit in oranges, lemons, and grapefruit. The mandarin as a rootstock seems to be a good "zinc feeder" frequently obtaining adequate zinc from a soil on which other citrus rootstocks show zinc deficiency in the scion leaves.

The Troyer Citrange at five years is the outstanding rootstock in the newer trials. It is a hybrid between Trifoliata as the pollen parent and Navel orange.

The Morton Citrange, a hybrid between sweet orange as the pollen parent and Trifoliata, has been of interest as a stock for Navels because of the excellent quality of the fruit, but, unfortunately, it has given fruit below average in size.

Eureka lemon, Riverside propagated from a Nucellar bud, is very vigorous and high yielding.

The Samson Tangelo, another hybrid, is a cross between Dancy Tangerine and Grapefruit. It is of great interest in current trials as an outstanding stock for lemons.

Trifoliata which, in Australia, has been looked to as an alternative to sour orange on heavier soils, has not been studied extensively in California, but nine strains are now undergoing test. They show an extremely interesting range in susceptibility to citrus nematode from nil to severe infestation.

Nucellar navel orange at right, beyond the frost pot, is more vigorous than a tree of the same age from ordinary navel orange on the left.

NUCELLAR BUDS

A citrus seed may contain a number of embryos and give rise to a corresponding number of seedlings. These seedlings may be divided into ordinary seedlings which result from embryos which have been fertilized by pollen and Nucellar seedlings which result from embryos which have not been fertilized at all. They grow, therefore, asexually from maternal tissue only. All seedlings are usually free from virus diseases carried by their parents, and the Nucellar seedlings produce, therefore, healthy tissue of exactly the same type as the tree from which the seed was taken. The ordinary seedling, though it would probably be free of virus disease, would tend to be quite different in character from its maternal parent. One use of Nucellar seedlings, therefore, would be to obtain budwood free from virus disease.

Another more general purpose in growing Nucellar seedlings, however, is to obtain buds carrying much greater vigor than buds taken from the maternal parent, and these Nucellar buds when worked on to rootstocks in the ordinary way may induce similar vigor. In their early years, Nucellar seedlings are usually thorny, but shoots produced as the tree gets older lose their thorny character and they may then be used as a source of budwood which will give trees as free of thorns as their original maternal parents.

The outstanding Nucellar material at the Riverside Experiment Station seems to be Nucellar Eureka lemon on sweet orange stock. At 30 years from budding the Nucellar Eureka is a much more vigorous tree with 40 per cent. more yield than ordinary Eureka.

The Lisbon lemon, which is normally a vigorous scion, is not outstandingly better when raised from Nucellar stock. Neither is the Valencia orange, but the Nucellar Navel is more vigorous at 30 years than the ordinary Navel on sweet orange, and there is a demand for Nucellar Navel buds for propagation.

"QUICK DECLINE"

In view of the extensive work on "quick decline" in Victoria—we know it as "bud union decline"—it is not necessary to refer at length to Californian work. Generally, the results obtained from work in the two centres are similar both in the field and in the laboratory. In California, infected buds obtained from different sources show a remarkable range in the virulence of the virus they carry. In some lines the whole of the inoculated test trees rapidly decline, while in others only a small percentage of the trees in the same time show collapse, the remainder showing only minor indications of infection. Whether this is due to different strains of the virus or an accumulation of more than one virus in a

Test tree into which three buds infected with "Quick Decline" were introduced on main arms 12 months previously. Note precocious cropping caused by the virus and restricted growth. Control healthy tree at rear.

virus complex, as in the case of the berry fruit viruses, or whether it is simply due to the concentration of virus in the test buds, is not known.

Though it seems evident from the nature of the spread of " quick decline " in California that an insect vector is responsible, no vector has yet been established. Sticky papers hung in the groves caught 245 species of insects visiting citrus trees, including 91 species of leaf hoppers, 48 aphid species, and 27 species of thrips. It has been found that, under the conditions obtaining in an insect-proof plant house, infected citrus trees do not readily show clear symptoms of the presence of virus unless they are subjected to low soil moisture conditions, practically to wilting point.

" Quick decline " does not sweep through a grove as rapidly as the very similar disease " Tristeza " of South America, which is carried by *Aphis Citricides*. In Southern California, of the trees newly planted in a heavily infected area only 30 per cent. had become infected in three years. Sweet orange and lemon are both established as carriers of the virus, and grapefruit can carry the virus, though it may not be a general carrier in the field. Grapefruit top-worked on to a sick tree and then worked on to a healthy sweet orange tree on sour orange rootstock transmitted the disease, but apparently healthy grapefruit inoculated on to sour orange rootstocks had not, after a period of a year, induced symptoms of " quick decline," though in the same time Valencia buds had caused definite decline on comparable sour rootstocks.

In view of the large percentage of Californian trees which are on the sour orange rootstock, interest is being shown in the ability of some trees to effect a partial recovery from " quick decline." There is the possibility that trees may develop a relative tolerance for the virus and continue to carry commercial crops, though at a reduced level. This seems, however, relatively unlikely, and certainly in Victoria, on our experience to date, we would be unwise to delay removal of affected trees.

PEST CONTROL

Particular interest attaches to a comparison of red scale control measures in California and Victoria. Fumigation of citrus trees is the favored method along the Murray Valley, spraying with oil being resorted to usually only when fumigation is unavailable. The reverse obtains in California where only about 30,000 acres are fumigated, over 200,000 acres normally relying on oil sprays to control red scale.

There are several reasons for this preference for oil in California. Citrus mites, which are not controlled by red scale fumigation, are a major problem in California, sometimes being more important than red scale itself. Thus, on fumigated groves spraying has still to be resorted to for mite control. Even where this additional spraying is not necessary the cost of fumigation is more than 50 per cent. greater than the cost of spraying.

It is generally feared in Victoria that continued oil spraying may have a depressing effect on the growth of the tree, and it is of interest to note that, despite the fact that the quality of spraying oils is controlled by regulation, in California, more than

in any other part of the world, there is still the feeling that oil sprays may have been partly responsible for the slow decline in vigor of trees and may affect fruit quality. There does not seem to be, however, in California any conclusive evidence that this is actually so, though, at times, some reduction in fruit quality has been recorded, and plant physiologists have pointed to a lower dry matter content in the leaves of oiled trees, as compared with those fumigated.

Californian regulations require spraying oils to disclose the degree of refinement by stating the percentage of unsulphonatable residue—that is, the paraffinic and naphthenic hydrocarbons which remain after deducting the aromatic or unsaturated hydrocarbons which are sulphonatable and which are considered to be mainly responsible for tree injury. Oils used on citrus in California have over 90 per cent. and usually over 92 per cent. U.R.

Light to light-medium oils are used for citrus and the regulations limit the degree to which such grades may be produced by blending of different distillation fractions of oil. Sellers are required to state the percentage of the oil which distils under 636° F., and there is, in addition, a limit on the range of distillation. The ultimate aim is to use " straight run " oils distilling over a narrow range of temperature in preference to blends of heavy and light fractions.

There is no feeling of complacency about the oils in use in California, and greatest interest attaches to recent researches in New York State and Pennsylvania on the insecticidal and phytocidal properties of the actual hydrocarbons contained in the oils. It is not impossible that if oils containing only the most effective hydrocarbons were available, the spraying strength could be reduced to quarter of the present level with a consequent reduction in the possibility of tree damage.

We should watch the progress of this fundamental research work and also the course of the field trials conducted on citrus in California. It would be of advantage, too, to consider the possibility of setting up standards for oils offered for sale in Victoria. It may be that superior oils will cost significantly more than standard oils do now, but American opinion is that such increases would be justified, judging by results obtained from the preliminary experiments already conducted.

A Californian spraying tower hydraulically elevated from the portable sprayer.

Oil sprays are used in California at a strength of $1\frac{2}{3}$ per cent. actual oil and the strength aimed at is that which is sufficient to kill the adult females. It has often been suggested that oil sprays should be applied when large numbers of scales are in the " crawler " stage, but entomologists at the Riverside Experiment Station pay no attention to " crawlers," holding that a spray sufficiently strong to kill the more resistant adult female is, in any case, necessary. The spray kills the female not by covering it but seeping underneath it.

Growth regulators added to the spray oil have been shown to reduce the tendency of trees to shed leaves and small fruits after being oil sprayed. A general recommendation has been made in California that six parts per million of 2–4–D may be added for this purpose. In addition, this practice has tended to increase fruit size and to reduce the amount of twig dieback. On lemons it has increased storage life by up to 50 per cent. by holding the buttons on the fruit for longer and thus reducing losses from Alternaria or " black central rot " which gains admission at the button scar.

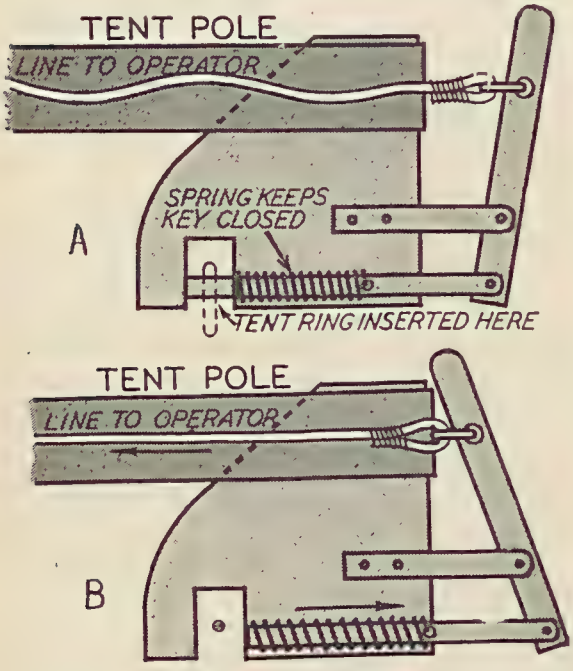
The new insecticide Parathion has given promising results against red scale at a strength of $\frac{3}{4}$ lb. per 100 gallons, but

Left: A typical mechanical tent puller for citrus fumigation in California. The team usually consists of five men. Centre: The arms of the tent puller heavily counter-weighted. Right: The tent is attached by loops to special attachments at the tips of the arms. Easy release of these loops is an essential feature.

at present prices it is too dear for use. From the public health point of view, Parathion probably would be much safer on citrus, because of the time of its application, than on other fruits.

SPRAY EQUIPMENT

Most spraying is done by contract in California, and the standard equipment used consists of a portable spray truck with a tank of 400 imperial gallons from which three hand-directed hoses are operated. Two hose-men an the ground spray the sides of the trees on either side of the spray truck while the third man occupying a tower, usually hydraulically elevated above the tank, sprays down on to the tops of both trees, using a specially modified walnut gun to produce a narrow and penetrating spray.



Spring release attachment for tent loops at top of the puller arm.

A pressure of 600 lb. can be maintained easily at the guns, but it is suspected that such high pressures frequently cause skin blemishes in the fruit and a pressure of 400–450 lb. is considered ample by careful operators. Thorough spraying is a feature of the work, 400 gallons being sufficient to cover adequately only about sixteen large trees of a height of, say, 13 feet to 15 feet.

The contract team consists of five men. Three hose-men already referred to, a driver for the spray truck, and a driver for the refilling unit. This is another truck with a 400-gallon tank and a quick delivery pump capable of transferring this gallonage in $1\frac{1}{2}$ to $1\frac{3}{4}$ minutes. Such a team would, on the average, spray about 600 trees a day, the contract price being 9s. per 100 gallons applied, plus the cost of materials. The cost of the spray outfit would be about £4,500.

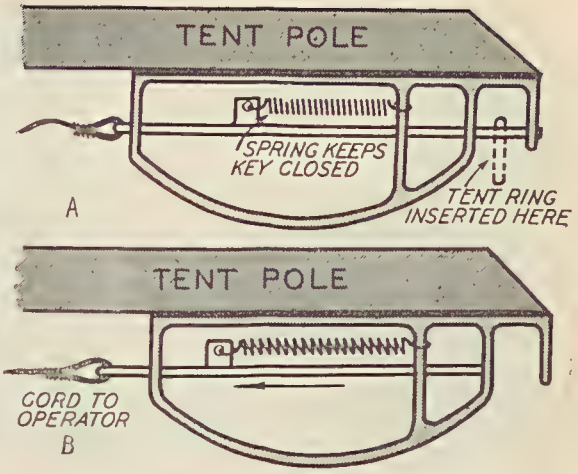
There does not seem to be much interest in the "speed sprayer" and similar air-carrier equipment in California, or in the fixed spray type of equipment, though the latter is used to some extent on lemons. Aerial spraying is not advanced in the citrus groves of California as it is, for instance, in the apple growing areas of Washington, but helicopters have been used to a limited extent. In one case, on lemons, 3 gallons per acre of a concentrated aerosol containing 2,400 parts per million of 2–4–D had been used to control fruit drop.

FUMIGATION

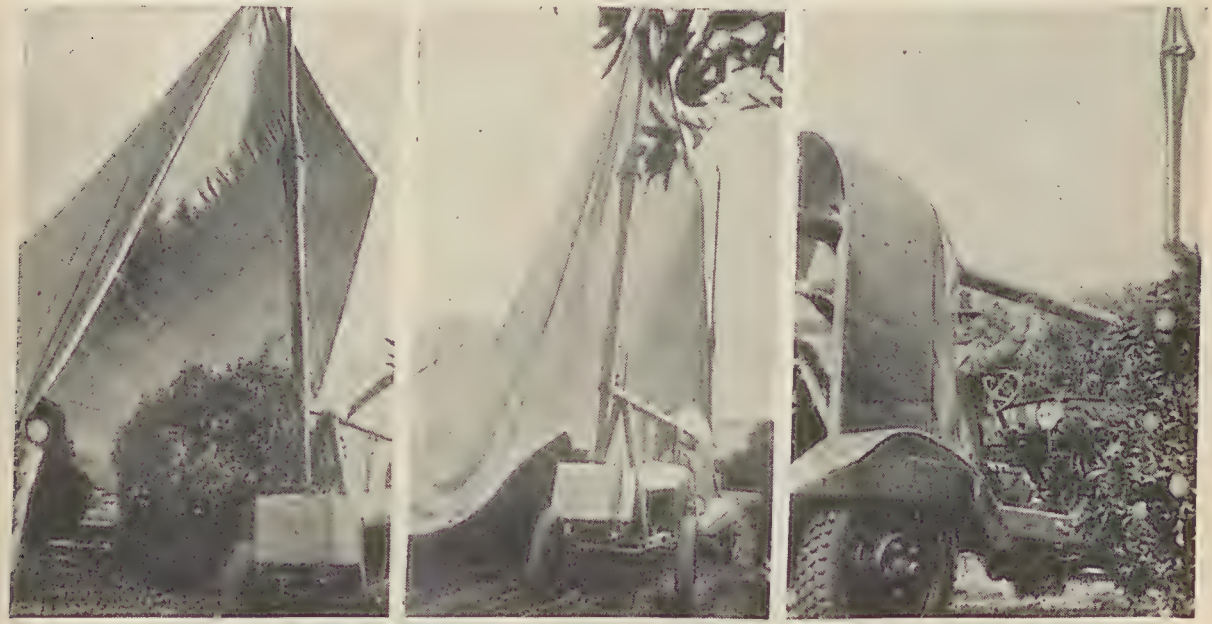
A strict comparison between fumigation of citrus for red scale in Victoria and fumigation in California cannot be made because while we use as a fumigant calcium cyanamide powder, the Americans use, almost exclusively, liquid hydrogen cyanide vaporized by heat prior to blowing into the tent. They regard the calcium cyanamide as being inferior in its kill, and more dangerous to the tree. Apparently, the dangerous nature of the liquid in transit and storage is one of the main reasons why it is not used in Australia.

With hydrogen cyanide, California can safely fumigate from July to the end of February, equivalent in Victoria to January to the end of August. Daylight fumigation is not practised, except that, through the winter months, work may commence at 3 p.m. to 4 p.m. when the air is still.

The standard tent material was previously 7 oz. to 8 oz. duck, but recently this has been scarce and most tents are now made of 250 drill, both materials having a tearing strength of 11 lb. to 12 lb. Nylon tents are convenient to use, being one-third the weight of duck and less than half the weight of drill, but the concentration of the fumigant drops slightly more rapidly under nylon than under the other materials. Actually, the nature of the material is not as important in determining the drop in concentration as are atmospheric conditions outside the tent. The cost of nylon is about double and there are relatively few in use. When new they have a tearing strength of 35 lb., but in twelve months this has fallen to 18 lb. The Dupont Company has been interested in the manufacture of a better nylon for fumigation tents. More interest, however, is probably being evinced in another synthetic product, Koroseal, which it is considered would be extremely durable in use.



Another type of spring release attachment.



Left: Tent partly elevated by rotating arms. Centre: Tent partly elevated and ready for release from arms. Right: The driver releases tent by pulling trip cords.

Left: The tent base is folded in securely and the circumference is measured by tape to determine the dosage. Right: A special applicator which measures, heats and pumps in gaseous hydrogen cyanide, is standard equipment in California.

A little while ago, there was considerable interest and research in America on gastight tents which would maintain a steady concentration of fumigant, but, even under experimental conditions they have proved very dangerous, and there is no interest whatever now in the use of such tents.

TENT PULLERS

Practically all tents are now pulled over the trees and removed after fumigation by mechanical means. In fact, it is impossible to obtain labor to manipulate the tents by hand because of the nature of the work. The tent pullers, overall, do not significantly reduce the cost of fumigation, but labor is offering for work in fumigation gangs where a tent puller is used. Where the machines can obtain a good long run on trees of moderate to large size and free of snags, they are probably a good deal cheaper than hand pulling, but on small trees and snaggy trees and broken runs, efficient hand pulling would probably be cheaper. On the previous night, a machine I inspected and a team of five men in a good run fumigated 760 trees. The typical gang of five men consists of one driver, two men to attach the tents to the arms of the tent pullers, one man to tuck in the base of the tent and measure it, and one man, who may be the foreman, to dose the tree in accordance with the previous measurement. The men are paid at piecework rates, about 3½d. a tree, and the foreman 4d. The average total cost to the grower would be about 4s. 6d. per tree.

The applicator for hydrogen cyanide, which can be wheeled easily from tree to tree, consists of an accurate dosage regulator from which the liquid fumigant passes through a copper coil in a water bath heated to 240° F. The water bath is heated by a steam coil, which itself is heated by a petrol burner. When vaporized, the fumigant is blown through a flexible hose under the tent. This method of application results in a rapid attainment of the maximum concentration within the tent, and seems to be quite standard in California.

RESISTANT SCALES

The presence of scales resistant to normal fumigation dosages is a frequent reason for using a combination of fumigation and spraying, the spraying follows the fumigation at not more than a month nor less than ten days interval. Apart from the problem of resistant scales, spraying tends to be more effective against the outer scales on the periphery of the tree, while fumigation tends to be more effective against scales towards the centre of the tree.

Where a grower suspects that he has a build-up of resistant scales on his grove, he may submit a sample to the entomologists at Riverside Station, who have developed a special test chamber in which the scales from the grove in question are fumigated under the same conditions as a control line of scales continually bred for this purpose in the insectory. The concentration

of fumigant in the test chamber is not kept constant, but matches the curve of concentration experienced under a field tent.

Resistance to fumigation in scales is a genetic factor. There are apparently two races of scales in California sharply distinguished by their susceptibility to cyanide. Each of these two races has been bred through twelve generations at Riverside and subjected throughout to fumigation tests. It has been found that they have not varied in their response to fumigation over this time. That is to say, scales do not acquire, as a result of fumigation experience, a greater resistance to subsequent fumigation. Their resistance, or otherwise, depends on inherited characters.

BIOLOGICAL CONTROL

The Division of Biological Control at Riverside aims at controlling citrus insect pests by the use of parasites. Already the yellow and black scales appear to be under biological control and the work on red scale and mealy bug is promising. There are, in California, some groves on which red scale does not build up, even though no spraying or fumigation has been practised for, in some cases, 7 to 8 years, and, in a few cases, even for 12 to 15 years. An intensive study of such groves is yielding results of the greatest interest.

The main predators on red scale appear to be lady beetles and the Golden Chalcid (*Aphytis chrysomphali*). Lady beetles attack adult scales while the Golden Chalcid attacks only young scales. A combination may, therefore, be desirable, but there are groves on which red scale seems to be naturally controlled where the Golden Chalcid is the only predator to be found, and it is considered to be the most promising of all the scale parasites.

Californian entomologists believe the Golden Chalcid to be world-wide in its distribution and to occur wherever red scale is found. They think this insect has been underestimated because it does not lay its eggs in the scale body, but instead the eggs are laid under the scale covering, the young chalcid feeding on the scale through a specially developed tube. Thus, in some groves where the Golden Chalcid occurs freely, there has been found a high mortality among the scales, but no direct evidence that this was associated with the Golden Chalcid.

The limitation in Chalcid control is considered to be due to the fact that natural variations in the numbers of Chalcids and scales throughout the year are out of phase, i.e., when scales are decreasing Chalcids would still be increasing if sufficient scales were present to support their greater numbers. It is necessary, therefore, in the insectory to do one of two things, either breed scales to be liberated as a source of feed at certain times in the grove, or to breed Chalcids in the insectory for liberation in the field at appropriate times. Over half a million Chalcids per day can be produced in the Riverside insectories for liberation, and though the work is only in the experimental stage, it is being prosecuted now with considerable and increasing vigor. In addition to the broad study of host parasite relationship, the entomologists are looking for strains of parasites which are particularly efficient.

It cannot be stated yet that biological control of red scale is practicable, nor that it will ever be practicable under all growing conditions, but Victorian citrus growers will watch with the greatest interest this work by a group of entomologists who believe that spraying and fumigation may actually be the *cause* of red scale by affecting in the long run the population of natural controlling parasites more than they control red scale itself.

FROST CONTROL

Losses through frost damage in agriculture annually in the United States are of the order of £40,000,000 to £50,000,000, and even in California serious frost losses may occur, as in 1937 and this year. In every Californian citrus grove, frost pots are in evidence—at all events, in the autumn in preparation for the winter months—and although new methods in frost protection have been put into commercial use in recent years, the oil burning pot is still, by far, the most common device used. However, California may be a net importer of oil in the near future and the increasing price of oil and the possibility of it being less available give added interest to the development of alternative methods of control.

The use of wind machines consisting of powerful fans erected on elevated towers is fairly extensive. We are, in Australia, familiar with this idea and, indeed, experimental machines in Victoria have been

constructed. There seems to be more possibility of them functioning well here than in California. In a Victorian frost, the depth of cold air lying on the ground is usually not more than 20 to 30 feet, and it is, therefore, possible for a wind machine reaching to that height to suck down warm air from on top of the frost layer blowing it down to the ground to mix with the cold air and raise its temperature. In California the frost ceiling is sometimes as high as 100 feet in a severe frost, and then the blowers do not work efficiently but, as an adjunct to the heating pots, they seem to be finding a market.

Much interest has been taken in the infra-red heating units first developed in Michigan. They consist of a kerosene burner heating a radiating shell of metal to a temperature of 1,500° F. and generating about 1¼ million B.T.U's. per hour, which is greater than the 1 million B.T.U's. per hour lost by an acre of soil at frost temperatures.

Infra-red frost burner developed at Michigan State College of Agriculture.

The Michigan people estimated that, when used in a group, the machines would each cover an effective area of between ¾ and 1 acre in crops such as low vegetables where shading was not a problem. A high percentage of the energy is given off in radiant form. Above the radiating surface is an aluminium reflector, and this, together with the shape of the radiator, directs most of the energy downwards towards the ground. The principle on which these machines is based is that, if the infra-red rays can be directed downwards towards the soil, they will travel until they strike the soil or some solid object and heat it. The soil or plants so heated will, in turn, heat the air above them. The advantage of this, as compared with the direct heating of the air by frost pots, is thought to be that the pots are heating a substance—the air—which is incapable of holding an appreciable quantity of heat and rapidly loses it by convection, whereas the capacity of the soil and plants to absorb heat and to liberate it more gradually is considerable. A projected development was the substitution of the metal heating surface with a huge "Welsbach" mantle to be heated, as before, with kerosene, the rate of burning being 10 gallons per hour.

How this new method of heating can be applied, if at all, to citrus groves where there would be considerable shading unless the towers were made very high would need to be determined by trial, but in one case in vegetables in the Coachella Valley of Southern California in the recent freeze, nine heaters are said to have given a rise of 6° F. over 4 acres.

The extent to which citrus growers in Australia have benefited by the research work done in California and the generous distribution throughout the world of the results obtained cannot be over-estimated. It is something for which we in Victoria should be particularly grateful, as our conditions along the Murray Valley approximate fairly closely to many parts of California, and Californian results are consequently often of direct applicability.

STANDARD HERD TEST REPORT

The 1948–49 Standard Herd Test report on pure-bred dairy cattle in Victoria, which is customarily published towards the end of the year, will not now be off the press until some time in January. This delay is due to pressure of work at the Government Printing Office, brought about by the Commonwealth Federal election and other urgent work.

This also resulted in the late dispatch of the November issue of the Journal.

LIVE STOCK NOTES

* * *

Compiled by
A. C. T. HEWITT,
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Live Stock Science Officer

* * *

REARING GOOD CALVES

AS a general rule calves should be bucket fed until they are between five and six months old, but if good paddock feed is available slightly younger calves down to four and a half months old, if well grown, may be weaned at this time of year. This will reduce work and provide more skim milk for pigs that have to be topped off and sold before milk yields fall too low.

The best cows are those which have been well reared, and which have not received setbacks as calves and growing heifers. For this reason alone much depends upon the way calves are reared.

Good meadow or lucerne hay is the best food to supplement pasture for growing stock. Concentrates are not necessary for calves over six months old when sufficient good roughage and pasturage are available. In fact, concentrates tend to fatten the animals rather than assist their growth, and, under Victorian conditions, where it is desirable to mate heifers at fifteen months old to calve at two years old, the heifers should be as well grown and developed as possible. This is best achieved by feeding good meadow or lucerne hay as a supplement to pasture.

During their first autumn and winter, when the heifers are a year off calving, they should be fed up to 3 lb. of good grass hay per head daily for adequate growth, with average seasonal pasture. During the second autumn and winter when they should be springing, they should be fed up to 6 lb. of good pasture hay per head daily for normal growth.

Normally, springing heifers require 6 lb. per day for not more than two months, and about 3 lb. per day for another two months. On this reckoning, each springing heifer would require 3 cwt. of hay during the year, and each yearling heifer 1½ cwt. of hay. These quantities could be taken as a minimum for young stock in working out a fodder conservation programme.

NEW ZEALAND CALVES DO WELL

The procedure of grazing calves in rotation around the cow paddocks ahead of the cows so that they get the best of the pasture before it is contaminated by either the calves themselves or the cows, is producing good results in New Zealand. Over the past seven years calves consistently grazed on fresh pasture averaged 76 lb. heavier at nine months old than calves reared by the usual method by allowing them to graze continuously in the same paddocks.

Heifers reared under these conditions have grown into higher-producing cows and have averaged 905 lb. more milk and 58 lb. more butterfat during their first lactations than calves reared under the usual method.

[A.C.T.H.]

PIG RAISING

Pigs thrive fairly well on a diet of separated milk alone or with pasture, but a greater profit per gallon of milk is obtained when the milk is fed in combination with grain and pasture. The most profitable proportions of milk and grain to feed depend on the relative prices of grain and pigs and the availability of milk. Generally, it pays to feed at least 1 lb. of grain daily to each pig irrespective of its size from the time it is weaned until it is a baconer. At least 4 lb. of grain daily should be fed to each sow suckling a good litter.

When wheat is fed at those rates, together with as much separated milk as the pigs can drink, it requires about 7 bushels of wheat and 400 gallons of milk for each pig bred and reared to 140 lb. dressed carcass weight. Separated milk and wheat, however, do not make a complete diet for pigs. The addition of pasture or meadow hay is necessary for good results.

Markets

Markets are available for pigs of pork or bacon weights. The Australian market, at present, is under-supplied and as prices here are not determined arbitrarily, but by supply and demand, today's prices are higher than usual.

A floor to the Australian structure of pig prices is provided by the export market. Great Britain is the main buyer of Australia's exportable surplus pig meat, and sales to that country are subject to contract between the Australian and British Governments. The contract includes arbitrary prices.

Management

The financial returns of individual farmers from their pigs vary according to the efficiency of their management.

Some farmers make more money than others by using less food for each lb. of pig meat they produce and by getting a higher price per lb. for that meat.

Factors in efficient pig production are, the size of litters, the growth rate of pigs, the economy of their food conversion and the quality of their carcasses.

Practices that give the best returns are, briefly, as follows :—

An ample supply of food is provided for the number of pigs kept. A mixed diet, such as milk, grain, and pasture or hay, is used.

The breeding and growing of pigs on the one farm instead of buying store pigs of inferior quality and at high prices is adopted as a policy.

Breeding stock are selected for their known or approved productive capacity and for their suitability of type. The large-framed type of boars and sows are best used for breeding baconers.

Breeding sows are fed so as to have them gaining in condition when mated and continuing to gain rapidly until they have reached fairly fat condition. Their daily food allowance is then restricted so that they shall not be too fat by the time they farrow.

Sows with litters and young pigs under four months of age are kept either in clean pens with impervious floors or on fresh pasture that has not been heavily stocked with pigs. These precautions reduce the risk to the susceptible young pigs from infestation by worms.

Sows that are suckling their litters are given as much food as they can eat to encourage them to milk heavily. The sucking pigs are encouraged to eat from a separate trough from three weeks of age until they are weaned.

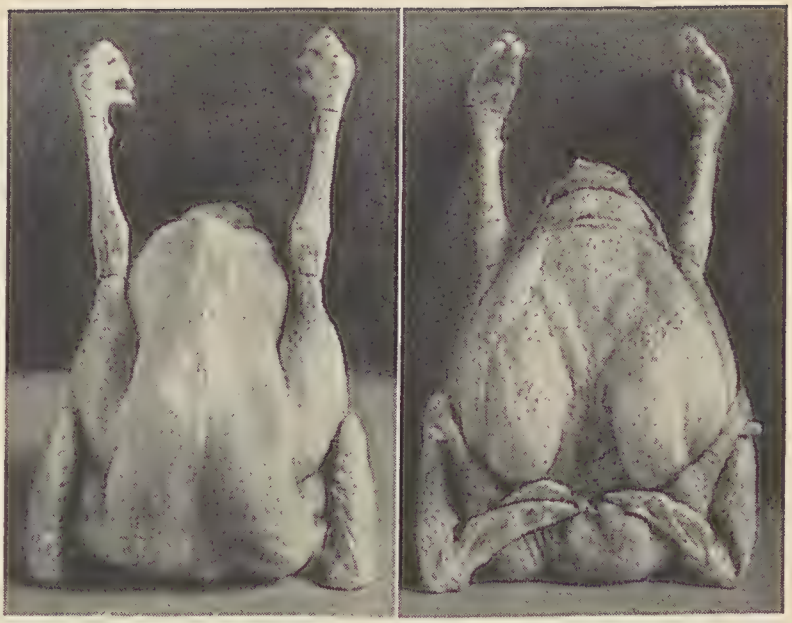
After weaning at about eight weeks old, the young pigs are given as much food as they can eat to grow them rapidly through the critical stage when their muscles are being developed.

When the growing pigs are fat enough (and that is not very fat) they are either sold irrespective of their weight, or, if it is desired to make them heavier, their daily food allowance is kept constant and not increased to satisfy their increasing appetites. Thus the pigs grow on slowly to heavier weights without becoming too fat, and that is how the buyers of pigs and bacon like them.

By encouraging early muscle development and restricting later fat development, pigs are produced with a maximum

of lean and an optimum of fat. Such pigs sell at high prices per lb. and are most economical to feed, as it takes more food to make 1 lb. of fat than 1 lb. of lean meat.

These points were made by the writer at a recent field day for pig raisers held on Phillip Island. In the course of the talk, some rashers of bacon containing the desired proportions of fat and lean were demonstrated. The mode of development of bone, muscle, and fat in the body of a pig were explained and the influence of particular methods of feeding on bacon quality was demonstrated.



Front and back view of a prime chicken correctly skewer-dressed for roasting.

With pigs provided for the purpose of demonstration, the selection of breeding stock, bacon-pig judging, and methods of holding, castration, nose ringing, and detusking were shown.

[L. A. Downey, H.D.A., Pig Expert.]

PREPARATION OF POULTRY FOR THE TABLE

In the selection of poultry for cooking purposes, there are two main classes, namely, a young bird which is termed a roasting fowl, and an older bird suitable only for boiling.

In a young bird the bone structure is soft. Therefore, the end of the breastbone will be soft and pliable. As the bird increases in age the bone structure hardens. This is the usual and the most reliable method of determining the difference between the two classes referred to, whether the bird is alive or dressed. In addition, the shanks and feet of a young bird are smooth and pliable, the feathers fine and soft, the skin supple and fine in texture, and the bird's entire appearance has certain qualities belonging to early stages of growth.

Most of the differences between the flavour of different breeds are undoubtedly due to the methods of feeding, preparation, and marketing rather than to breed distinction. Palatability and quality of the flesh are the most practical and important considerations, and colour of flesh, legs, and feathers are considerations of prejudice. A plump-breasted table bird of good quality will naturally have a better flavour than that of a poor bird.

Fasting before Killing

The bird should not be fed for about 24 hours before killing, but a regular supply of clean, cool drinking water should always be available. This starving for a while allows the crop and intestines to become emptied of food, and the bird will therefore keep much longer before cooking.

Dressing

After plucking, provided the weather is suitable, the bird should be kept hanging, head down, in a cool place for about twelve hours before dressing. See that the legs and feet are thoroughly clean. The toes can be chopped off, or preferably the sinews may be drawn.

Drawing the Sinews

First, make an incision across the front of the shank about midway between the foot and the hock. Snap the bone at the part where the incision is made, but do not cut off. Twist the lower part of the shank around a few times, causing the bone to protrude through the skin. A piece of rope or wire formed into a loop

and fastened to a post or wall is necessary to extract the sinews. Place the lower part of the shank and foot in the loop, grasp the leg firmly around the hock, and give a strong downward pull and the sinews will come away. Chop off the ends of shanks neatly.

To Draw

Cut off the head at the top of the neck. Slit the skin at the back of the neck down to the shoulder. Separate the skin from the neck and cut the neck off about 1 inch from the base. Remove the windpipe and crop from the neck end. Cut down each side of the neck to the shoulder bones and insert the finger well into the breast cavity, loosening all ligaments that attach the internal organs to the body. Reverse the bird and make an incision between the tail and vent. Insert the finger and detach all ligaments and connective tissue, particularly the layer of fat connected to the gizzard near the point of the breast. If this loosening method is correctly applied the internal organs should come away quite easily.

To Truss for Roasting

Pass the skewer through the skin at the elbow joint. There is a strong sinew running along the outer extremity of the wing, and it is necessary that the skewer be placed between this sinew and the bone. This fastens the skewer firmly to the wing. Force the leg up so that it projects beyond the back of the bird, and pass the skewer through the flesh under the leg joint. Pass the skewer across the back of the bird and fasten the other leg and wing in a similar manner. Chop off any excess skewer remaining after the bird is trussed. To tie the legs down, place the bird on its back with the breast towards you. Place the string under the back near the tail, then bring each end of the string up against the body, over the fleshy part of the legs near the hocks and around to the back where it should be securely fastened. The legs may be straightened by making a small incision across each leg near the hock. Finally, turn the ends of the wings back behind the shoulders, thus holding the skin of the neck in position.

[M. D. Hall, Poultry Expert.]

PROTECTION OF HONEY COMBS FROM WAX MOTH

Of the two wax moths which cause trouble in Victorian apiaries *Galleria mellonella* (greater wax moth) *Achroia grisella* (lesser wax moth), the greater wax moth is the most prevalent and destructive.

Combs not required by bees in weak hives should be transferred to strong hives or stored away and fumigated. When circumstances permit, surplus combs should be put on strong hives for a few days periodically throughout the summer months to enable the bees to "deal with" the moth larvae. Otherwise they should be stored under cover from the weather, but where as much light and air as possible can pass between the combs. Where this is not practicable, fumigation is necessary.

There are several kinds of fumigants which are more or less effective, and of these chlorosal is recommended. This will destroy the larvae of the wax moth, and also kill the eggs. One fumigation only is necessary. "Chlorosal" is easy to apply. There is no danger of fire, and, being slow to evaporate, it is not dangerous to the operator. It can be made by mixing three parts of ethylene-dichloride and one part carbon tetrachloride.

Combs for fumigation should be placed in a specially-prepared room, which is as airtight as possible, or in supers stacked to whatever height is convenient. Paper is pasted over all cracks. As the fumes are heavier than air, the chemical should be placed in open containers at the top of the combs before they are covered. One gallon of chemical should be used for every 1,000 cubic feet of space to be fumigated. Combs should be kept sealed until required for use to prevent re-infestation, but allowed to "air" for a short time before they are put on to hives.

If chlorosal cannot be conveniently obtained, carbon bisulphide is recommended for use in the above-described manner. It is effective against the moths and larvae, but will not destroy the eggs. It is quick to evaporate and extremely dangerous to use, being highly inflammable and explosive; also, great care should be taken not to inhale the fumes.

[C. D. Ilton, Apiary Inspector.]

IMPACTION IN CATTLE

by W. A. Snowdon, B.V.Sc., Veterinary Officer

THE correct functioning of the fore-stomach in cattle is necessary for normal health and maximum production. Impaction or overloading of the paunch is one of the most common disease conditions affecting cattle, especially when hand-fed. It has various causes, of which overfeeding or eating indigestible substances are probably the most common. Impaction is likely to occur where owners feed their cows heavily to obtain better milk and butterfat returns, or when stock have access to mouldy hay or silage.

Calves up to the age of six months, which have free access to silage, lucerne, hay, or straw—foods which they cannot digest properly when taken in excessive amounts—are prone to the trouble. Impaction also may follow a sudden change in feeding—for example, from pasture to intensive hand-feeding at calving time; or it may occur in cows in which the bowels have not been evacuated by means of a purgative after recovery from an attack of milk fever.

Symptoms

The first noticeable symptoms are loss of appetite, failure to ruminate, and decreased milk production. The bowel evacuations are scanty, dark, and firm. The animal exhibits a depressed or dejected appearance, not wishing to move and standing with its head hanging. Respiration may be rapid and shallow, accompanied by grunting.

Only in severe cases is abdominal pain shown when there is paddling of the hind feet, kicking at the belly, swishing of the tail, and turning the head towards the flank.

In the late stages there is a general stiffness when paralysis of the hindquarters may develop and the animal goes down. It is at this stage that the owner may confuse the condition with milk fever.

Some indication of the stomach's condition may be gauged by the application of pressure to the left flank with the fist. The normal stomach gives way readily to pressure, whereas the impacted paunch feels full and doughy.

Treatment

The aim of treatment is to evacuate the alimentary canal and restore it to its normal function. The food intake of the animal should be markedly reduced, especially of grain.

The paunch may be emptied with a drench of 1 to 2 lb. of Epsom salts combined with molasses. If there is no response within 24 hours, dose again with the same quantity of Epsom salts together with 2 to 3 gallons of water. After administration of the drench, knead the paunch with the fist for ten or fifteen minutes at intervals of four hours until relief is obtained.

As an alternative drench, 1 gallon of liquid paraffin or 1 quart of linseed oil may be used. If impaction is accompanied by bloat, 1 tablespoonful of turpentine, or 1 dessertspoonful of formalin, may be added to the above drenches.

Prevention

The following preventive measures will go a long way towards keeping the herd free of the trouble:—

(1) Avoid excessive overfeeding where possible. The feed-shed and grain paddocks should be made secure against roaming cattle, including young calves.

(2) Ensure that cows do not have access to indigestible materials such as mouldy fodder, afterbirth, &c.

(3) Avoid sudden changes of feeding.

(4) See that cows, after recovery from milk fever are given a purgative to evacuate the bowels.

Pork and Bacon Pig Competitions

Melbourne Royal Show, 1949

By L. A. Downey, H.D.A., Pig Expert

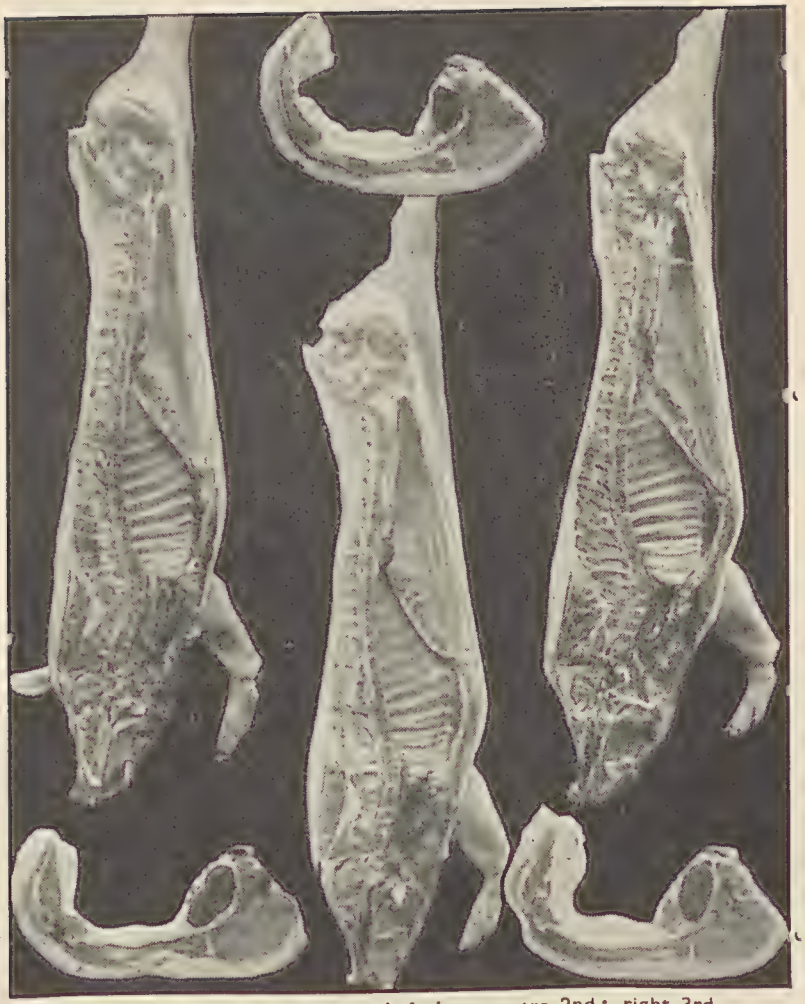
THE pork and bacon pig competitions at the Melbourne Royal Show are unique because (1) they are judged on a factual economic standard that recognizes the requirements of people who buy and eat pork and bacon; (2) the judge's findings are presented so as to educate competitors and Show visitors; and (3) the displays of the live pigs and the cut pig meat contribute to the spectacular side of the Show.

Designed first for the 1940 Royal Show, these two pig competitions were conducted at the Melbourne city abattoirs when it became necessary to cancel the Show because the R.A.A.F. was in occupation at the Showgrounds. The competitions were again run at the abattoirs in 1941 after which practical difficulties caused their discontinuance. For the last four years these competitions have been included in the pig section of the Melbourne Royal Show.

Left to right: Sides and loin cuts of the 1st, 2nd and 3rd prize bacon-pig carcasses.

The prizes provided for these two competitions this year included £83 in cash, a cup valued at £10 10s. and a trophy valued at £15 15s.

In 1940, 1941, and 1946, the competitions were judged on the combined results of the weight of litters of pigs at eight weeks old, the weight-for-age of the pair of pigs from each litter comprising an entry at the Show, and the quality of the carcass of one of these two pigs. At the instance of some competitors, the first two parts of the judging were deleted after 1946 and since then, awards have been made only on the appraisal of the carcass of one of the pair of pigs comprising each entry.



The prize-winning porkers. Left 1st; centre 2nd; right 3rd.

techniques. Further, by exhibiting, they provide other pig raisers with valuable object lessons. The experience of the veteran competitors does not prevent novices from getting among the prize winners.

The average standard of the carcasses in these competitions is greatly superior to that of the majority of trade pigs. That is because the show pigs are well bred and carefully selected by skilled pig raisers and are fed to produce the desired proportions of lean and fat in their carcasses. Some sceptics may say that the same care could not be taken with ordinary trade pigs. The author and some of the entrants in these competitions will not concede that point. However, the main value of these competitions is in their showing the correlation between live appearance and the pork-chop or bacon-rasher appearance of pigs. That is important to pig raisers who see their pigs alive but rarely see the same pigs "on the plate."

As the carcasses are appraised on the Smithfield system in which measurements count most, and very little scope is allowed for the individual judge to vary the points awarded according to his opinion, comparisons of the points scored as between entries and between years are valuable.

In Table 1, the awards of three years' competitions show steady improvement in the average quality of the entries. That improvement can be taken as an indication that competitors learn from these competitions and, having learned, do not make serious errors in the breeding and feeding of their pigs for future competitions.

The value of the competitions is not reduced because, approximately, the same competitors are in them each year. Those experienced competitors continue to strive to improve their pigs; some try new

The conditions of the pork and bacon competitions require that each entry shall consist of a pair of pigs from one and the same litter, and that, when weighed at the Show, the two pigs shall not have a difference in live-weight exceeding 25 lb. in the case of baconers and 15 lb. in the case of porkers. A draw is made to select the one pig from each entry that is to be slaughtered.

The live pig remains in the show pen for the duration of the Show, while the best seven porker and best seven baconer carcasses are exhibited in a refrigerated, glass-fronted show case at the Government pavilion in the showground. The carcasses are cut to expose one side and a section of the loin at the last rib (see photographs).

Pigs of any pure breed or first cross between pure-bred parents are eligible to compete.

The dressed carcasses, to be eligible for competition, must be not less than 60 lb. and not more than 100 lb. in the pork class, and not less than 130 lb. or more than 200 lb. in the bacon class.

Particulars of entries and the points scored are shown in Table 2.

An interesting feature of the results was the very rapid growth rate of most of the pigs. As the fast growth was consistent with good carcass quality, these results provide more evidence that pigs need not be grown slowly to make good carcasses provided they are the right type. In other words, the feeding and breeding should be adjusted one to the other to obtain good meat.

TABLE 1.—SUMMARY OF POINTS SCORED IN COMPETITIONS HELD IN THE LAST THREE YEARS.

Highest Scores.

Years.	Porkers.	Baconers.
1947	78	86½
1948	79½	86
1949	86	86

Average Scores.

—	Possible Points.	Average for Porkers.			Average for Baconers.		
		1947.	1948.	1949.	1947.	1948.	1949.
By Inspection—							
Hams—well filled and fine bone	8	4	4·1	5·7	4·9	6·5	6·7
Shoulders—light	7	4	5·4	5	3·5	5·5	5·3
Streak—thick, full of lean meat	12	7·8	6·1	10·4	9·5	6·3	8·85
By Measurement—							
Loin muscle—thick	28	14·1	15·7	17·9	20·6	22·6	22·3
Back fat thickness—Correct proportion ..	20	15·2	15·0	13·7	12·9	15·0	16·5
Body Length—in proportion to weight ..	20	15·7	17·9	17·1	9·5	11·7	11·85
Leg length—short	5	1·2	1·2	1·7	3·0	3·0	2·9
	100	61·9	65·4	71·6	63·9	70·6	74·4

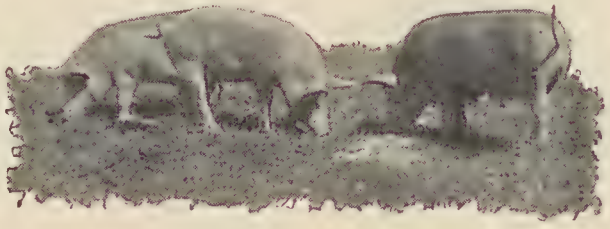


Table 2.—Pork Pigs.

Breeder's Name.	Breeding of Pigs.		Age Days.	Live Weight lb.	Carcass Weight lb.	Points.	Place.
Castle, L. H. ..	S. Clarendon Matador 7th ..	Large White	107	109	78	86	1
	D. Rose Valley Duchess ..						
Richards, A. H. ..	S. Eastside Premier 7th ..	Large White	82	101	68	78	2
	D. Somersleigh Dot 4th ..						
Simpson, R. D. ..	S. Histon Blackberry Lad (Imp.)	Large White	122	113	79	77½	3
	D. Rosvaudon Mademoiselle 36th						
Fairchild and Clutterbuck	S. Egerton Renown 22nd ..	Large White	116	117	83	76	4
	D. Vaucluse Vanity 359th ..						
Simpson, R. D. ..	S. Stanton Vanguard	Large White	118	134	88	75½	5
	D. Rosvaudon Sunbeam 14th ..						
Haywood, A. R. ..	S. Arnore Vale Skipper ..	Wessex x Saddleback	121	95	69	74½	=6
	D. Windrest Blanchette ..	Large White					
Whelpton, B. ..	S. Kinilibah Brigadier.. ..	Berkshire	121	128	88	74½	=6
	D. Belmont Marlene 3rd ..						
Hawtin, I. E. & F. ..	S. Hillsia Swell Guy	Berkshire	124	128	89	73½	8
	D. Rossmoyne Brenda 86th ..						
Castle, L. H. ..	S. Clarendon Matador 7th ..	Large White	107	96	67	73	9
	D. Rosevalley Duchess ..						
Whelpton, B. ..	S. Kinilibah Brigadier ..	Berkshire	119	117	82	70½	10
	D. Belmont Connie 8th ..						
Richards, A.H. ..	S. Eastside Premier 7th ..	Large White	82	92	60	70	11
	D. Somersleigh Dot 4th ..						
Fairchild and Clutterbuck	S. Staghorn Premier 17th ..	Large White	127	126	85	65	12
	D. Vaucluse Vanity 359th ..						
Clark, P. W. & Son ..	S. Kinilibah Brigadier.. ..	Berkshire	104	113	83	64½	13
	D. Hemswell Empress.. ..						
Longerenong Agricultural College	S. Rosvaudon Histonian Lad 4th	Large White	116	101	70	64	14
	D. Longerenong Primrose 280th						
Haywood, A. R. ..	S. Windrest Atom Bomb	Wessex Saddleback	118	122	90	51½	15
	D. Windrest Leading Lady ..						

Bacon Pigs.

Hawtin, I. E. and F.	S. Hillsia Swell Guy	Berkshire x Large White	177	195	145	86	1
	D. Rossmoyne Maiden 180th ..						
Hawtin, I. E. and F.	S. Hillsia Swell Guy	Berkshire x Large White	177	208	151	84	2
	D. Rossmoyne Maiden 180th ..						
Simpson, R. D. ..	S. Rosvaudon Majestic Knight..	Large White	249	229	171	77½	3
	D. Rosvaudon Moonbeam 24th						
Castle, L. H. ..	S. Cefn Wonder 75th	Large White	192	232	179	77	4
	D. Clarendon Linda 5th ..						
Northey and Co. ..	S. Vaucluse Lucky 15th ..	Large White	186	206	161	76½	5
	D. Koorilla Park Jewel ..						
Castle, L. H. ..	S. Cefn Wonder 75th	Large White	189	228	177	76	6
	D. Clarendon Linda 12th ..						
Simpson, R. D. ..	S. Histon Blackberry Lad (Imp.)	Large White	188	181	130	74½	7
	D. Rosvaudon Lady Mollington						
Cockbill, W.	S. Fulham Beryl Boy 7th ..	Large White	140	219	164	68½	8
	D. Fulham Molly 7th ..						
Fairchild and Clutterbuck	S. Staghorn Premier 17th ..	Large White	205	254	195	68	9
	D. Vaucluse Belle 117th ..						
Whelpton, B. ..	S. Helmswell Special	Berkshire	205	254	197	67½	10
	D. Belmont Senorita 6th ..						
Osborne, L. R. ..	S. Green Isle Starlin 4th ..	Large White	201	222	177	64	11
	D. Green Isle Patricia 5th ..						
Fairchild and Clutterbuck	S. Staghorn Premier 17th ..	Large White	205	265	208	76	*
	D. Vaucluse Belle 17th ..						
Noble, T. M. and Sons	S. Coree Wonder 178th ..	Large White	149	155	113	71½	†
	D. Finchley Jewel 260th ..						

* Carcass Overweight. † Carcass Underweight.

MILKING SHED DESIGN

Competition for Dairy Farmers

THE Department of Agriculture will shortly undertake some investigations into the design of milking sheds for the machine-milking of cows. The chief purpose of the investigations will be to test some recent innovations in milking shed design including the "elevated bail" type of shed developed in the U.S.A. Before commencing the trials, it is felt that dairy farmers should be given an apportunity to put forward any worthwhile ideas which they may have regarding the best design of milking shed to ensure economy of labour, expeditious milking of the herd, ease of supervision over cups and udders during milking and more congenial work for the milker.

To stimulate wider interest it has been decided to inaugurate a competition for the most improved design for a milking shed and to offer the following prizes out of funds obtained from the Commonwealth Dairy Grant:—

BEST MILKING SHED DESIGN

PRIZE LIST.

	£
First Prize ..	.. 250
Second Prize ..	.. 100
Third Prize ..	.. 50
Fourth Prize ..	.. 25

In addition, ten cash prizes of £10 each and ten cash prizes of £5 each will be offered for suggestions on minor but worthwhile points in shed design or construction, useful milking shed gadgets and fittings.

Any promising suggestions obtained from the competition will be examined and tested by the Department during the course of the investigations abovementioned.

CONDITIONS OF THE COMPETITION

1. The judge's decision shall be final and no correspondence will be entered into regarding the judging of the competition.

2. The award of any prize shall be subject to a report from the judges that the entry has attained a satisfactory standard.

3. Entries for the competition in shed design should consist of scale plans of milking shed together with separator room or dairy, wash room, yards, &c. All dimensions should be shown on the drawings, and buildings should be drawn in elevation as well as in plan. Entries in the gadgets and fittings section should be similarly illustrated, but £5 prizes may be awarded for workable suggestions of a novel character even though unaccompanied by scale drawings.

4. Plans should be accompanied by sufficient explanatory matter to indicate to the judge the features that are claimed to be novel and the advantages to be obtained from them. If the ideas put forward have already been incorporated in an existing milking shed the address at which the shed is located should be stated so that the shed may be viewed by the judge if necessary.

5. The purpose of the competition is to enable dairy farmers having useful ideas as to how the job of milking a herd may be facilitated by better shed design, to submit those ideas for examination. The competition will therefore be confined to bona fide dairy farmers who are not connected in any way with the manufacture of dairy farm equipment.

6. The Department reserves the right to publish with acknowledgment in the *Journal of Agriculture*, plans or suggestions of sufficient merit, but no fee or payment of any kind will be made for material so published.

7. All entries must be addressed to the Superintendent of Dairying, Department of Agriculture, Melbourne, and marked, "Milking Shed Competition".

8. Closing date for the Competition is 30th January, 1950.

Soil Drift Control in the Mallee

NINTH ANNUAL COMPETITION

Report by the Judge, R. G. Thomas, M.Agr.Sc., Senior Conservation Officer, Soil Conservation Board.

The Mallee Soil Drift Control Competition this year attracted 37 entrants, representing almost seventy thousand acres. It is pleasing to see new entrants, particularly from the northern and eastern parts of the Mallee, where interest in the competition had not formerly been strong. For reasons quite unconnected with the competition, judging this year was carried out in February, about a month earlier than usual. This proved fortunate, as the judging was completed before the abnormal rains of late February. Farmers will realize that errors in working and stocking land might well be masked by cultivation and growth subsequent to such rains.

A comfortable Mallee home set in attractive, sheltered surroundings.

AWARDS AND COMMENTS

Hanslow Cup

MESSRS. A. Schack and Son, Gama, gained the main award this year. These competitors have, on two previous occasions, won the Hanslow Cup.

The property of 2,346 acres consists essentially of two parts; Mr. Schack's original holding, and adjoining property which had suffered severe erosion before being taken over by Messrs. Schack and Son. The most striking feature of the property is the manner in which this severely eroded land has been stabilized. But perhaps a better tribute to the skill of the farmer is the condition in which the original holding has been held. Portions of this could readily have "blown" in the same way as did the ridges on the adjoining property.

It is rather difficult to describe the methods used to prevent erosion on this property because of the wide range of conditions and the many practices used. The secret of success lies, perhaps, in the constant care of the soil. Evidence of this care is everywhere apparent. The farmer is on the look-out, not so much for the occurrence of erosion, as for the likelihood of its occurring, and is prepared to do anything and everything that may become necessary to hold the soil, as soon as the need for this becomes apparent.

Variations in soil type determine land use on Mr. G. S. Staples' farm. The lower country is under fallow, in preparation for wheat; the lighter, higher country is under stubble.

The treatment of the eroded land to date has consisted of cultivation and cropping, in an endeavour to level the surface and re-establish vegetation. Wheat, principally, has been grown, but cereal rye has been used on all the "blown" ridges, on sand dunes, and on light areas liable to blow. Cultivation has been carried as far as possible over the blown areas, and where exposed limestone could not be worked over, the seed has been broadcast. Brush and other rubbish also has been placed on non-cultivable areas to catch soil that must inevitably move from the sandy "banks" at the sides of the badly-blown ridges.

Generally, a satisfactory growth and crop production has occurred, and even on the badly blown ridges, some cover now exists. The presence of this vegetation makes less difficult the task of preventing "drift" during the cultivation preparatory to cropping. It should here be mentioned that this programme of cultivation and cropping cannot be continued indefinitely without affecting soil fertility and stability, and particular care will have to be exercised when this land is "out to grass" or crop is grazed off.

Features of the cultivation practices are that ploughing and cultivation are carried out only when the ground is wet; the time of fallowing varies with the class of land, the "rises" being left to last; stubble is never burnt; and cover crops of rye or oats are sown where there is thought to be insufficient old stubble or other vegetation to work into the fallow. Cover crops may be sown at fallowing, usually by early August; the crop is allowed to develop well before grazing, and is then lightly fed off. Maximum use is made of even light spring and summer rains by cultivating small areas that are considered likely to blow, or by cultivating strips where the hazardous area is too large to be worked completely. Other small areas liable to drift, may be temporarily covered with brush.

Particular care is paid to the stocking of the property; it is on such management that the success or otherwise of the cultivation programme and erosion control measures so largely depends. One ewe is carried to just over five acres, and fat lambs are raised. These figures, together with an average wheat yield of 12½ bushels per acre over the last three seasons, indicate satisfactory production, which, of course, is a prime consideration to all farmers.

Mr. G. M. White, Torrita, secured second place in this year's competition. As when previously inspected, this property showed every evidence of careful management. The particular feature of the property is that for several seasons past, cover crops of oats have been sown when "fallowing", and the land has not again been cultivated until the following autumn.

Last season a considerable growth of oats was left over the summer, and Mr. White reported some difficulty in cultivating on this account. This season the oat cover crop was fed more heavily and the amount of growth left, although still adequate for soil protection, should not prove a difficulty in autumn cultivation. The cover crop was principally of oats, with rye on one sharp ridge.

The yield of wheat following the cover crop of last year was, in Mr. White's opinion, below that from the best of district fallows not cover-cropped last season, but above the yield from fallows affected by paddy melons and heliotrope ("potato weed").

One paddock which had not been fallowed for some years on account of the liability to "drift" was, this year, fallowed and cover-cropped, indicating this competitor's confidence in the ability of the early-sown and carefully grazed cover crop to hold "drifty" country. Apart from this paddock, the usual rotation practised has been fallow, wheat, and oats. The last-named crop is used for grain, hay, or grazing as circumstances require. The cover-cropped fallow is prepared with the "Sunderseeder" in July and August; subsequent cultivation in autumn is usually with the spring-tooth cultivator. Stubble land is sown with the "Sunderseeder".

Rye makes better growth than wheat on light ridges. The photograph shows rye stubble on a sandy ridge (right), and wheat stubble on left. It is good farming practice to grow rye where wheat will not thrive.

Last year, 340 ewes were carried on the 1,360 acres, and a further 250 lambs fattened. This indicates a high return from sheep, which is made possible by the extensive use of oats as a cover crop and for sowing on stubble land. Average yields of wheat over the past three years compared very favorably with those of other entrants in the Walpeup Shire.

Third place is gained by Mr. G. S. Staples, Rainbow, whose farm of 630 acres is run on lines differing considerably from most Mallee farms. Stock play a more important part in the farm economy than usual, the carrying rate being the highest in the competition (one breeding ewe to every 2·5 acres). The cropping programme is more diversified than usual, with wheat, oats, and barley all grown according to their suitability for particular areas.

This farm illustrates perhaps better than any other in the competition the principle of differential treatment of land according to the differences in soil, because the soil types are followed closely in determining the boundaries of the various cultivation and cropping treatments. This results in "blocks" of irregular shape, the boundaries of which approximate to contour, since the soil types largely follow the topography. Mr. Staples considers the disadvantage of irregular-shaped blocks is more than counterbalanced by the regular load on the tractor, and the more even absorption of rain induced by the level furrows and/or cultivation ridges. The principle of differential treatment of land according to soil type, is subscribed to by all competition entrants.

Mistakes can be costly. This strip was missed when sowing rye on a light rise. Note depth of soil blown from the unprotected strip.

Because of the importance attached to stock-carrying, fallowing is carried out later than usual. Despite this, wheat yields are among the highest in the competition, this no doubt being due to the fact that wheat is sown only on land capable of producing good crops. Barley and oats take the place of wheat as the principal crop on the lighter areas. Fallow is usually restricted to the heavier land, the lighter land being fallowed only when this is necessary to control weeds. When so fallowed, the lighter land is cover-cropped.

The rotation aimed at is fallow, wheat, stubble grazed and disced up in late spring, then sown to oats in autumn and grazed for eighteen months. As already indicated, oats or barley are substituted for wheat on the light land and this may not be fallowed. The rotation however, says Mr. Staples, must be flexible enough to meet varying seasonal conditions. This year barley and oats intended for feeding-off and cover crop were left and harvested for hay and grain.

Stubble has not been burned on the property for over 25 years, and ground is cultivated only when wet. Barrel clover is being tried as an aid during the pasture period but, so far, Mr. Staples has found it necessary to bring the land back into cultivation before the clover has become established, in order to control weeds.

This sand-dune is advancing over a road. Correct treatment could stabilize it and the eroding ridge behind.

KARKAROOC AND DIMBOOLA SHIRES

First and second places were taken by Messrs. A. Schack and Sons, and Mr. G. S. Staples, respectively, with Mr. H. G. Hilton, Hopetoun, occupying third place.

Mr. Hilton's property carries a fairly high degree of erosion hazard, and has suffered considerable erosion in the past. Its condition this season reflected good judgment in carrying out the season's operations so as to prevent any further drift and to improve country already affected. Rye had been used on ridges previously "blown", and had provided a fair cover. A criticism is that the area sown to rye might, with advantage, have been extended, as the amount of rye stubble was in marked contrast to the wheat stubble alongside.

Fallow had been judiciously handled, and soil movement was apparent only in an odd patch of blown land. The treatment of the four fallow paddocks illustrated the use of several of the recognized methods of fallow preparation. One paddock had been disc-ploughed in September, and scarified after rain in October and again in December. This is a "drifty" paddock and this "late fallow" treatment held it in good condition.

A second paddock had been ploughed in June, scarified in July, "combined" to 40 lb. of oats per acre in August, fed off in October–November, and scarified after rain in December. This can be regarded as normal "cover crop fallow", except that there is seldom sufficient rain to necessitate the December cultivation. Soil in this paddock varied considerably, but even the lighter soil had held very well. A third paddock had been sown to 40 lb. of oats with the disc drill in March, the resultant growth fed off, the paddock then ploughed in October, scarified in November and part scarified in January. This illustrated the early autumn sowing of a cereal to provide sufficient vegetation to work into the soil when fallowing. The fourth paddock of "heavy" land had been ploughed in June, scarified in September, and part scarified in January.

WYCHEPROOF AND KERANG SHIRES

Mr. H. G. Broad, Woomelang, secured first award, with Mr. H. Gillies, Beauchamp, in second position.

Mr. Broad's property was in very good order this year. This competitor and his son are emphatic about the need for a range of implements to suit particular conditions, and also the need for modifications to standard machinery. In this regard they usually have something to show and this year the features were rubber-tyred wheels, interchangeable between scarifier and disc cultivating plough, and a small ribbed wheel fitted on the scarifier. This wheel runs on the ground near two closely-placed tynes and assists the passage of stubble through the implement.

The surface soil has been blown from this gentle slope. Rain water, instead of being absorbed, has run over the clay surface, cutting small gullies.

Fallow had been prepared by various means, determined by soil type and condition at time of working. The scarifier is preferred for cultivation, and for a first working when the land is in the right order, as this implement keeps the stubble at the surface. If the land is too wet, the desired ridging is not obtained, the soil tending to settle back into a flat condition.

The scarifier had been used to prepare some of this season's fallow and had done a particularly good job on land fallowed after rain in October. Other areas had been respectively disc ploughed in winter and scarified in October, scarified winter and again in October, mould-board ploughed winter and spring-tooth cultivated (modified implement) October–November, and mould-board ploughed twice.

The above treatments emphasize again the opinion that there are no hard and fast rules to guide Mallee farmers in cultivating their land. On this farm, two principles are well illustrated. Land is not fallowed unless it has a sufficient body of stubble or other vegetation to work back into the soil, and different soil types are given different cultural treatment according to their type and condition at the time.

Less spectacular than steep sand dunes, banks of soil along fences indicate that even flat land will drift if not carefully handled. The boundary fence (above) has been almost buried by drift from the paddock at left (west), when under fallow.

Mr. H. Gillies formerly cropped some of his paddocks in strips, on a fallow-wheat basis. This gave effective control of erosion largely because of the small area cultivated in one piece at any one time. It did not, however, provide for the maintenance of soil fertility by crop rotation and the use of stock, and cannot therefore be regarded as a satisfactory treatment from the long-term view-point. The writer's observations lead to the belief that

A troublesome spot in a fallow paddock. Rye sown here after the land has been roughly levelled would stabilize the area.

what may be termed the physical aid of strip working is unnecessary if due regard is paid to the various other measures that have been stressed from time to time in these reports and elsewhere. Basic of these is the use of a rotation that will allow the maintenance of soil fertility.

Mr. Gillies is now working other land on shares, and so has been able to grow oats and barley and reduce the amount of wheat grown on his own farm. Paddocks are now treated as units. Fallow this year had been prepared in August and October, and was in good order.

SWAN HILL SHIRES

A consistent competitor in Mr. A. G. Pearse, Nyah West, won first award in the Swan Hill Shire competition, with Mr. J. H. Wright, Manangatang, in second place.

Mr. Pearse's farm is notable for two things which are rare in the Mallee, and becoming more so. Cattle are carried instead of sheep, and all cultivation is done with horses. Mr. Pearse contends that, over a long term, financial returns from cattle on this farm compare favorably with those received from sheep on other properties. Added to this, the grazing habits of cattle are such that soil conservation is aided; cattle do not graze close to the ground and thus leave sufficient vegetation to protect the soil. Mr. Pearse states that there is always ample vegetation to plough when fallowing, even though paddocks may be left out to grass for several years. This, and working land only when wet, are Mr. Pearse's guiding principles.

Good judgment was evidenced in the condition of the fallow. One section on which "drift" had accumulated from an adjoining paddock had been encouraged to blow down to the old ground surface by harrowing. Treatment of this nature is unfortunately necessary in places, but must be done with great care, and every means taken to prevent excessive soil movement. The ploughing of emergency furrows may be necessary, and rye should be sown as soon as seasonal conditions permit.

Mr. J. H. Wright, Manangatang, is one of the younger entrants in the competition. The property in the past has suffered appreciable erosion, principally on the ridges. Its condition this year showed a marked improvement on that of last year. Fallow prepared with the mould-board plough in July and scarified in October was in good order—clean, cloddy and well-ridged. Other fallow ploughed July–August and scarified September and November was rather too fine.

Good use had been made of rye on ridges, although the area sown was rather too limited on account of shortage of seed. A good job had been done with rye on sandy country adjacent to a water channel. This section of channel had in other years been badly affected by drift sand and had been a costly section to clean. This year the channel was free of "drift".

Water to the house and garden has aided the development of a garden and fruit trees which must add greatly to the comfort of the home, and of which the Wright family can be justly proud.

WALPEUP SHIRE

It is pleasing to find new entrants in the Walpeup and Mildura Shires, and particularly so to find them sharing in the awards. In the Walpeup Shire first award went to F. W. and R. Boettcher, of Murrayville, with Mr. P. B. Leach, Walpeup, in second place.

The Boettcher property was up to the high standard of former years. Fallow had been worked skilfully and was in safe condition. Rye had been sown as a cover crop on the light ridges, which had been fallowed and sown early. Other fallow was ploughed late and left; ample straw was worked in to hold it. Rye had also been sown more extensively than with most competitors on the "drifty" ridges of crop paddocks, and barley was grown on light land. Sections of old drift banks along paddock boundaries had been harrowed to encourage some soil movement and levelling.

Mr. Leach is a new entrant, and an ex-serviceman, who is working a property of which portion was acquired only two years ago, and on which considerable erosion had taken place. A very creditable and successful effort has been made to re-vegetate eroded areas. Ridges and also a heavy flat which had eroded have been worked up and sown to rye. The method has been to roughen up the ground in the winter or spring, using a five-furrow plough with furrows 1 and 5 only operating. Very intractable country can be handled in this way and then worked over and sown in the autumn. An excellent rye stubble was seen on land so treated, and a further area was in course of treatment.

Some drift had occurred on portion of the fallow. Mr. Leach had hoped to achieve a levelling effect from soil movement at this area but, as invariably happens, the movement of soil had been in the wrong direction. On another section, the discing of fallow at time of inspection to kill melons and "potato weed" created a possible erosion hazard. Despite this criticism, Mr. Leach's handling of his farm had resulted in an evident improvement and deserved great credit.

MILDURA SHIRE

Mr. L. J. Fraser, Werrimull, won this section in his first year as a competitor. The property is of 1,162 acres of typical undulating Millewa country. Rye has been used to advantage on the lightest ridges, with oats in preference to wheat on other rises. One ridge, which had previously blown and which had since been left out of cultivation, was this year sown with rye. The seed was broadcast where drilling was impossible, and an adequate cover had resulted.

One paddock of wheat stubble which had suffered hail damage was being disced over to give seed coverage in the expectation of a self-sown crop. A home-made grader, made by attaching an old header tyre (straightened) to the feet of an old five-furrow plough, had been used to move old drift banks from fence lines.

Fallow was on the fine side and rather flat, but did not show much movement on account of the quantity of rubbish worked into it. Part of the fallow had been mouldboard ploughed in June–July, and scarified after rain in January; a part had been ploughed and not cultivated, while the balance had been disced in August and scarified in October and January.

The nature of this northern country generally makes it extremely difficult to maintain fallow in a cloddy or a ridged condition. The vegetation which is worked into the fallow must, therefore, be relied on to prevent soil movement. All northern Mallee farmers know the difficulty of providing that vegetation under adverse seasonal conditions. This in turn emphasizes the need for careful stocking to ensure a carry-over of dry "feed" from the good seasons.

Wind-blown ground ridged preparatory to sowing with rye. A five-furrow plough was used with only the first and last ploughs operating.

Messrs. Ruchel and Sons, Meringur, second place winners, also appear in the competition for the first time. These farmers have been prominent in crop and fallow competitions over a number of years. They soon learnt to modify the then accepted ideas of correct fallow preparation to suit the erosion hazard existing on this rolling country. They are confident that they can continue to hold the country in production by retaining all crop residues, working land only when it is wet, limiting cultivation speeds to 4·2 miles per hour, and keeping stock numbers down to safe limits. Single furrows are ploughed across fallow as an emergency measure if drift commences.

Rye and oats had been grown on one ridge preparatory to late fallow in October, but more use might be made of rye to ensure adequate bulk of straw on ridges affected by earlier drift. Fallowing is commenced in July, and is carried on as the weather permits. The mould-board plough has been commonly used, with the disc where the amount of rubbish makes this necessary. Subsequent working is kept to the minimum necessary to kill weeds.

The tandem disc has latterly been used for working stubble, and by rigging a drill to run between the sets of discs, has been used also for sowing both stubble and fallow. Wheat is sown after the first break in April, and is usually sown before the end of May. The shelter provided against dams is a feature of this property.

COMMENTS ON OTHER ENTRIES

Many other entries are worthy of special mention. In the Karkarooc–Dimboola section the standard remains high. New entrants in Messrs. H. W. Ackland, W. C. Jones, and G. D. Barbary and Sons all had features of interest to show, while other competitors maintained the high standard of previous years. Although not given a place this year, Messrs. F. J. Hoffmaier and Sons have farmed their property in an outstanding manner, whether judged from the point of view of its stable condition or high level of production.

Mr. C. Smith of Wagant, Ouyen, presented some unusual angles in his approach to the problems on his property, much of which is too "limey" for successful cultivation under the rainfall normally received. Mr. Smith returned from military service to find the country bare and windswept. He decided to run the property as a grazing proposition, with crop as a sideline and principally as a means of improving the grazing. Mr. Smith's contention is that only by stock-farming can the soil fertility be built up in an economic manner. The blown ridges have been sown with rye and super., two seedings being made in one season when necessary, and oats used on other light areas. Small areas have been sown to wheat. Trial areas of barrel clover and lucerne were sown in 1947.

A patch of evening primrose sown twelve years ago had persisted despite some cultivation, and another patch was sown in rye stubble. These trials will be watched with interest. The country was initially stocked very leniently, but numbers have now been built up to one sheep to five acres.

Mr. D. Leach is another Walpeup entrant whose property has novel features. Of his holding of 3,500 acres, only 840 acres are cleared. This had partly reverted to scrub and has been brought back to cultivation. Some burning of stubbles to kill shoots has been necessary. Of the "scrub" land, 1,600 acres carried 400 sheep for three months in the last drought. It has since been spelled and Mr. Leach estimates that it would carry 150 head of sheep for six or seven months. On the cleared land, late fallowing is practised, and the scarifier is preferred. Cultivation is thus limited to autumn working. The fallow was in safe condition, and the whole property free of noxious weeds.

In the eastern areas, Mr. H. W. Miles, Mystic Park, fallowed later than usual in order to try and hold rising land that had blown under normal fallow during other years. Results to time of judging were entirely satisfactory. Mr. G. E. Fox, Lalbert Road, is a new competitor, most of whose farm was in good order. He is, however, still handicapped by inability to re-establish cover on one gentle ridge which "blew out" badly some years ago, following a stubble burn and sowing without rain.

GENERAL COMMENT

The Mallee this year was again seen under favorable conditions. Seasonal conditions last year had been generally good, more so in the western and northern areas. Despite the favorable season, however, there was evidence of the ease with which Mallee soils will drift unless carefully handled. Furthermore, the writer has been reliably informed that more drift occurred subsequent to the February rain than prior to that time.

A good line of Crossbred ewes on a Mallee farm. Sheep, if properly handled, help maintain fertility of the soil and aid cultivation ; if wrongly managed, they can aid erosion.

There is indeed no occasion for complacency in respect to the control of soil drift in the Mallee. Entrants in the competition have shown that soil drift can be controlled. They have shown too, how even those who realize the seriousness of the problem and are making conscious efforts to control it, can make mistakes in their treatment of the soil, and thus allow erosion to temporarily gain the upper hand.

Two things impressed the writer in the course of his travels through the Mallee this year.

The first was the increased use of cereal rye for sowing on eroded land and sand dunes, and for sowing also on the lighter ridges which cannot be relied on to grow a sufficient crop of wheat to give enough stubble for soil protection. This is to be commended and it is hoped that continuance of an export trade will lead to an increase in the latter usage of rye.

At the same time, there is a need for all concerned to appreciate the limitations of rye in respect to the reclamation of eroded land and sand dunes. The view is often expressed, or implied, that eroded land which has been sown to rye and has produced something of a crop, has been "treated" and "cured". It has, in fact, merely been stabilized. It has eroded before and has lost its best (top) soil. Therefore, unless treated with the greatest of care it can erode again and the effort at stabilization and control will have been in vain.

The second matter was that some farmers appeared to be building up their stock numbers. This was in part due to inability to profitably dispose of last season's lambs at the appropriate time, and the favorable seasonal conditions which allowed lambs to be carried over. Farmers should be well assured, before building up stock numbers, that they have the two essentials referred to in earlier competition reports—adequate fodder reserves and a safe area on which to feed stock. Otherwise heavier stocking and temporarily higher returns will inevitably be followed by losses through having to sell sheep on a falling market, or loss of soil through over-grazing and trafficking, or more probably, by losses on both counts.

My thanks are tendered to all competitors and to officers of the State Rivers and Water Supply Commission who co-operated in the judging of the competition. Mr. H. Hanslow, although retired from the Commission, gave evidence of his continued keen interest in the welfare of the Mallee by again accompanying me during the judging, and I particularly desire to thank him for so doing.

SUMMARY OF AWARDS.

Hanslow Cup—
Messrs. A. Schack and Son, Gama.
Mr. G. M. White, Torrita.
Mr. G. S. Staples, Rainbow.

Karkarooc and Dimboola Shires—
A. Schack and Son, Gama.
G. S. Staples, Rainbow.
H. G. Hilton, Hopetoun.

Wycheproof and Kerang Shires—
H. G. Broad, Woomelang.
H. Gillies, Mystic Park.

Swan Hill Shire—
A. G. Pearse, Nyah West.
J. H. Wright, Manangatang.

Walpeup Shire—
F. W. and R. Boettcher, Murrayville.
P. B. Leach, Walpeup.

Mildura Shire—
L. J. Fraser, Werrimull.
Ruchel and Sons, Meringur.

Mildura District Field Day

Compiled by G. W. Gayford, B.Agr.Sc., Senior Horticultural Instructor

THE annual citrus field day in the Mildura district this year was held at Irymple on 26th October. The function, which was conducted by the Department of Agriculture in conjunction with the Mildura and District Citrus Co-operative Association, took place on the Department's rootstock trial at Messrs. Leng Bros'. grove.

Welcoming visitors and Departmental officers, Mr. S. E. Keenan, President of the Association, emphasized the importance to the district of the experimental work being conducted there and the value to the citrus industry of the results of this work. Regret was expressed by Mr. Keenan and Captain D. B. Halhed, that this would be the last field day at which Mr. J. M. Ward would attend in his official capacity as Superintendent of Horticulture, in view of his projected retirement.

The Superintendent of Horticulture, Mr. J. M. Ward, opening the Field Day.

Opening the field day, Mr. Ward referred briefly to the changes which had taken place in the citrus industry over the past quarter of a century. From a wide range of orange varieties the district now produced mostly Navels and Valencias which were able to provide fruit throughout the year. Careful attention to bud selection and the reworking of off-type trees had improved the quality of citrus being produced, but growers should not slacken in this regard. The danger of transmitting a virus disease by careless bud selection was very great, and this also should be given careful consideration. A virus disease of grapefruit which had caused serious damage in South Africa and Queensland, was characterized by a dimpling of the trunk of the tree. There were trees in the Mildura district which showed very similar symptoms.

Fruit fly was a grave menace to the fruit industry of Victoria and the outbreak in Mildura in 1923–24 was successfully eradicated. The recent outbreak in East Gippsland was being dealt with and no effort was being spared in preventing the spread of this pest to commercial fruit districts.

Mr. Ward outlined some of his experiences during his long association with the fruit industry. During that time he had seen it pass through many vicissitudes, but could not agree with some of the gloomy prophets of overproduction. In a young country such as Australia there should be no need for restrictions on plantings.

The following talks given at the field day are summarized hereunder :—

CITRUS FERTILIZER AND ROOTSTOCK EXPERIMENTS

Discussing citrus fertilizer and rootstock experiments, Mr. D. M. McAlpin, B.Agr.Sc., Horticultural Research Officer, stated that the results to date of the stock trial planted at Messrs. Leng Bros., Irymple, in 1934, have shown the superiority of Washington Navel and Valencia Late oranges on Symons' sweet orange stock.

The other stocks used in this experiment are the normal-type citronelle (Rough Lemon) and sour orange (Rough Seville).

This superiority is reflected in tree size, health, yield of fruit and its quality, whether the trees are growing in Murray Sand, Barmera Sand, or Barmera Sandy Loam soils.

Many of the trees on citronelle stock and on sour orange are sick or dead. The trees on citronelle stock are affected most by boron poisoning which is reducing the cropping considerably besides giving sparse foliage with typical leaf symptoms.

Boron poisoning was first identified in Australia two years ago by the Victorian Department of Agriculture, and is now known to be rather widespread in horticultural crops throughout the Murray Valley.

Trees on sour orange first showed the "bud union decline" disease in 1941, and, since then, a number have become unthrifty, some dying. This disease, which research work by Parsai, McAlpin, Roberts, and Hope has shown to be a virus disease spread by our commonest black citrus aphis *Aphis taveresi* (Del. G.), syn *A. citricidus* (Kirk.) also attacks grapefruit and mandarin varieties on sour orange stock.

The fertilizer experiment which is included in this stock trial has three different combinations of fertilizers:—(1) nitrogen—as sulphate of ammonia, 8 lb. per tree in one early spring application; (2) nitrogen + phosphorus (8 lb. sulphate of ammonia + 12 lb. superphosphate); (3) nitrogen + phosphorus + potassium (8 lb. sulphate of ammonia + 12 lb. superphosphate + 4 lb. sulphate of potash). These treatments have been given since 1944 but no differences are evident yet.

As a result of the outstanding performance of trees on sweet orange stock, a new experiment has been laid out this year on a deep Murray Sand sandhill adjacent to the 1934 planting. The new trees have eight different strains of sweet orange stock collected from proved trees in many parts of Victoria and four different varieties worked on these stocks. The varieties include two navel oranges—Washington Navel and Leng Navel, and two Valencia Late oranges. There are ten trees of each of the 32 combinations in this experimental area which should give vital information within a few years and indicate accurately the possibilities of the various sweet orange stocks and performances of the two Navels and two Valencias on these stocks.

ROOTSTOCK TRIAL, MESSRS. LENG BROTHERS' GROVE, IRYMPLE.

Stock.	Washington Navel.			Valencia Late.		
	Sweet Orange.	Citronelle.	Sour Orange.	Sweet Orange.	Citronelle.	Sour Orange.
Tree Size (cms.)—						
Trunk Circumference ..	61	48	48	70	60	60
Height	370	330	330	390	360	360
Width	410	370	360	380	360	360
Yield per Tree .. lb.	420	220 (1949 crop)	310	450	405 (1948–49 crop)	400
Total Yield of Fruit (since 1938 lb.)	67,500	57,500	56,000	55,000	48,500	49,000
Fruit Quality—						
Percentage Juice	53	50	50	60	57	59
Percentage Rind	34	37	37	31	32	31
Percentage Rag	13	13	13	9	11	10
cc. N/10 Soda	18·6	16·8	20·1	17·0	12·9	16·7
Brix	11·2	10·3	11·5	13·2	11·5	12·4
	(Samples for analysis picked 1st week June, 1949)			(Samples for analysis picked 30th November, 1948)		

ORGANIC MATTER IN CITRUS SOILS

Nature of Organic Matter

In an interesting talk on organic matter in citrus soils, Mr. A. G. Goudie, B. Agr. Sc., Horticultural Research Officer, pointed out that, while the actual composition of humus varies in different districts and in different soil types, humus in a group of similar soils in the same district would have closely similar composition, no matter from what type of organic matter it derived. Humus probably consists entirely of certain bacterial and fungal skeletons which are highly resistant to further decay. In addition to humus, the soil normally contains enormous numbers of living bacteria and fungi, and plant remains in various stages of rotting.

Washington Navel orange or Sour orange rootstock, showing sudden collapse due to bud union decline disease.

Organic matter is important, but not essential for the successful growth of plants —vegetable crops grown in water culture (hydroponics) bear just as heavily as field crops. Fundamentally, sufficient organic matter makes it simpler to keep a continuous supply of inorganic nutrients available for the crop.

Beneficial Function of Organic Matter

Some soil organisms convert ammonia to nitrate, which is usually more acceptable to plants; others convert sulphur to sulphuric acid—that is why sulphur can be used to reduce soil alkalinity; other organisms destroy toxic products of rotting, and probably slowly destroy most poisons, such as 2–4.D., added to the soil by man

Plant remains are rotted down and the minerals locked up in their dead cells are made available to growing crops and soil organisms.

Organic matter is about three times as effective as clay in holding mineral nutrients and soil moisture for plants. There is only slightly more than 5 per cent. clay in Winkie Sand; 8–10 per cent. in Murray Sand; and 12–14 per cent. in Berri Sand. A fertile grove could be expected to contain 1 per cent. organic matter and this would therefore represent quite a large fraction of the nutrient-holding and water-holding capacity of such soil. The CO_2 liberated during decomposition of organic matter tends to lower the alkalinity of the soil and might be an advantage in this district

Maintenance of Soil Organic Content

American workers claim that, under oil-spray methods, falling citrus leaves and dying rootlets are sufficient to maintain organic matter at a satisfactory level. Loss is therefore very slow unless erosion occurs.

Quality of added organic matter is of utmost importance because soil organisms tend to rot everything down to a common composition—they compete like weeds for anything extra they need to carry out the rotting process. Nutrients not required by the organisms are largely liberated and become available to plants.

AVAILABLE NUTRIENTS IN LUCERNE HAY AND WHEATEN STRAW, AFTER ROTTING.

	Pounds per Ton.				
	Potassium.	Calcium.	Magnesium.	Phosphorus.	Nitrogen.
Lucerne Hay ...	25	35	10	4	55
Wheaten Straw ..	15	3	2	1	8

Organisms would require something like ¾ cwt. of added sulphate of ammonia to rot down a ton of wheaten straw; and only a low yield is obtained of plant nutrients other than potash. Lucerne hay, on the other hand, would yield considerable amounts of all nutrients except phosphorus. The final yield of humus per ton would be similar in both cases and would probably be something less than 4 or 5 cwt. Tick beans and field beans are of comparable quality to lucerne; packing shed waste, and orchard grasses are comparable to straw.

Packing shed waste contains about 10 per cent. sugar. This can turn to gum during decomposition. On heavier citrus soils, this gum can block the soil pores for some weeks and seriously reduce the intake of irrigation water. Therefore, only apply it to alternate rows in any one year. Apply it early—late autumn if possible—and let it lie on the surface until the spring cultivation Add extra nitrogen—say ½ cwt. sulphate of ammonia per ton.

THE STORAGE AND EXPORT OF ORANGES

Dealing with the storage and export of oranges, Mr. G. B. Tindale, B.Agr.Sc., Cool Storage Research Officer, said that the limiting factor to the successful storage and export of oranges is the onset of moulds—usually the common green or blue penicillium moulds.

Notwithstanding very careful handling, within a few weeks or even days after picking, a few odd oranges within the case usually go mouldy. When exported to New Zealand, the cases cannot be disturbed after packing and these few "initial" infections rapidly infect their neighbours by "nesting", so that a case which may have only say 2 per cent. of mouldy oranges when it leaves Melbourne may, by the time it reaches New Zealand, have increased its wastage to say 15–20 per cent.

Experiments have been conducted by this Department for some years in an effort to overcome the mould problem in oranges. It has been found that the storage life of navels is over by September, after which it is normal for most navels to go mouldy, irrespective of treatment. The big problem, however, is to prevent, if possible, the onset of moulds in navels stored or exported during the navel season of June, July, and August.

The most promising line of attack to date is the use of water-proof wraps to prevent nesting, and the use of fungicidal dips to prevent initial infections. Experiments on these lines were continued this year with navels obtained from Messrs. Leng Bros. of Irymple. Navel oranges were obtained from trees grown on citronelle, trifoliata, sweet orange, and sour orange stocks. Nine cases were obtained from trees on each stock and of each nine, three cases were wrapped in a water-proof polyethylene wrap, three cases were dipped in a fungicidal emulsion (a wax emulsion to which was added 4 per cent. borax and 2 per cent. boracic acid), while three cases were untreated. The oranges were then consigned to Melbourne, and, on 21st June, 1949, were stored at 45° F. at the Government Cool Stores.

In addition, another parcel of nine cases from the citronelle stocks was stored in a chamber at 45° F. into which ozone gas was continually liberated. The oranges were examined after approximately one, two, and three months' storage. Examined at the end of September and early October, losses by mould attack were exceptionally high. That was only to be expected for, by then, the oranges were overstored. Very interesting observations were made, however, from examination after one to two months storage.

Most wastage occurred on oranges grown on citronelle stock and least on oranges grown on trifoliata stock. In all instances there was considerably more wastage in the oranges which had not been treated than in the oranges which were dipped or wrapped before storage. The dipping treatment was very effective for at least one month's storage after which occasional oranges developed mould. The dip treatment, however, did not stop these odd infections from infecting their neighbours, so that, ultimately, the wastage in the dipped fruit became considerable. With regard to the wrapped fruit it seemed that the particular wraps used were too water-proof, for although they completely prevented nesting, yet wastage within the wraps was considerable due, no doubt, to the fact that the moisture transpired by the oranges was completely trapped

within the wrappers resulting in moisture depositing within the wrapper as dew. The high humidity so created, undoubtedly favoured mould development. Thus, in all instances the wrapped fruit developed more mould than the dipped fruit after one month's storage, but the position was reversed with longer storage, for by then, nesting had started in the dipped fruit but not in the wrapped fruit.

It is likely that a wrapper not so completely impervious to water vapour would be much more effective. A very outstanding result was the effect of ozone in reducing mould wastage.

Further tests would warrant the combination of dipping and wrapping in waterproof wrap. Such a combination may result in the reduction of mould losses to negligible proportions, while further work is warranted with the use of ozone gas in the storage chamber.

COMMERCIAL RED SCALE CONTROL PROGRAMME

The danger of allowing the red scale population on citrus to build up was stressed by Mr. R. Roberts, Orchard Supervisor, who deplored the fact that there were still some growers who, through apathy or want of thought, made no effort to take effective steps to control this pest until it was too late.

The 1948–49 season will be looked upon as one in which the number of trees which have been treated either with hydrocyanic gas or white oil was well above average, and the number of trees treated would have been higher still if fumigation companies and spraying contractors had been able to commence operations earlier and to continue operations during the dried fruits harvest.

With an expansion of from less than 500,000 bushels in 1940–41 to 700,000 bushels in 1948–49, it was time growers and packers realised that the citrus industry should be no longer subordinate to dried fruits, and remodelled their pest-control plans to safeguard this industry. Red scale reproduction in this district was more or less continuous. It was sheer folly to think that this pest could be eradicated by suspending all control measures during the dried fruits harvest, the best months of the year for scale "kill".

Fumigation was still the best means of scale control, but growers must realise that, while every grove cannot be fumigated at the same time, packing houses and contractors have made provision for oil-spraying trees where fumigation may possibly be delayed or where trees were too small for profitable fumigation. The onus was on the grower to see that his trees were treated, either by fumigation or, failing that, by oil spraying or a combination oil-spray plus fumigation, a programme which had proved its efficacy over the past few seasons.

To summarize briefly, red scale is best attacked as follows:—

Annual treatment, or, where the infestation is heavy, more than one treatment during the season. In severe infestations, oil-spray plus fumigation is the most satisfactory method of control.

Dry trees absorb oil excessively. This is detrimental to the tree, and reduces scale "kill". Therefore, trees should be thoroughly irrigated *prior to* oil spraying. Where fumigation is to be carried out, the soil should be relatively dry, and the trees irrigated *after* fumigation.

Navel growers who supply the early market are advised to fumigate early, as oil sprays delay the gas colouring of oranges. It is a mistake to reduce the dosage in fumigation; check temperatures and humidity, and give the correct dosage.

Check up on scale early, and carry out treatments before the scale population has time to build up. Contrary to general local belief, experimental work overseas has shown that high temperatures caused little or no mortality among adult scales, but a sudden drop in temperature was responsible for a high mortality of scales in the second moult stage.

RESULTS OF RED SCALE CONTROL EXPERIMENT

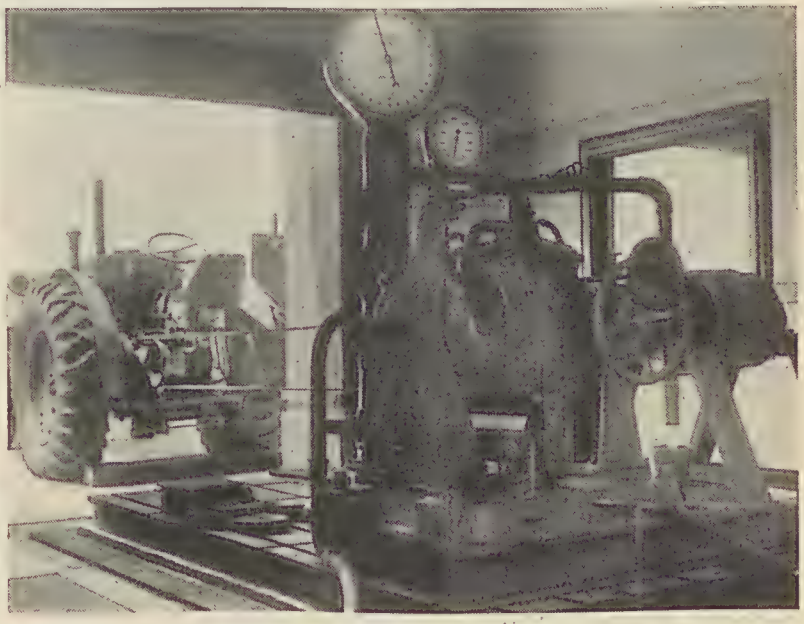
The results of the red-scale control experiment were discussed by Mr. C. J. R. Johnston, B.Agr.Sc., Entomologist, who stated that sprays of DDT and E.6.0.5. were tried on citrus trees for scale control in comparison with oil. DDT plus oil was not effective. In fact the scale increased under this treatment, probably due to the effect of the DDT on other insects preying on red scale. E.6.0.5. plus oil did not improve control over the use of oil alone.

(continued on page 569.)

SUMMARISED TRACTOR TESTS

By G. J. Fitzwater, Machinery Officer, Machinery Section.

TRACTORS have become the power prime movers used in primary production on rural properties, both large and small, and the number of tractors on Victorian farms and pastoral holdings has grown amazingly since the war. Tractors vary in their efficiency and there is need for reliable information on the capacity or performance of various types and models of tractors. With the object of furnishing the knowledge sought in a concise and authoritative manner from an independent source, arrangements have been made with the Commonwealth Department of Supply and Development by the Victorian Department of Agriculture, acting in conjunction with the Agricultural Engineering School of the Melbourne University, to have tractors officially tested by the qualified engineers at the Commonwealth Aeronautical Laboratories, Fishermen's Bend and the State Research Farm at Werribee, whenever required.



Tractor belt test coupled to DPY5 dynamometer at the aeronautical laboratories, Fishermen's Bend.

It must be appreciated that, with the importation into Australia of tractors from various sources such as America, England and the Continent of Europe, it becomes desirable to establish official tests for their belt and drawbar power performance, using the fuels normally available here and operating under local conditions which differ materially from overseas conditions in many instances as does the gallonage measure. Also, with the advent of increased manufacture of tractors for agricultural and industrial purposes in Australia, it is desirable to establish comparable tests with units imported from other countries and classify them accordingly.

The testing procedure adopted at Fishermen's Bend is similar to that established and practised by the Nebraska University (U.S.A.) Agricultural Engineering College with which reciprocal arrangements have been instituted. Nebraska University figures have become accepted throughout the world as the standard for the official testing of tractors in America.

All tractors tested are certified by their distributors as being stock model machines, conforming to specifications and catalogues filed with the application for test by the Department of Agriculture. Only qualified engineers and skilled operators are in charge of the tractors when all test results are obtained.

It is assumed that the application for test is made with the knowledge of the tractor company and that it is not an experimental but an official performance test to be run under the specifications submitted and the testing rules in force. One of the rules is that there shall be no revision of specifications

Fuel-measuring equipment used for tractor tests at Fishermen's Bend.

after the test starts, nor any change of equipment except to make replacement for that which may be defective or broken.

A representative of the distributor concerned is requested to be present during the test and operate the tractor during the "limber up" run and make any adjustments he may consider necessary before the test. In addition to these duties the distributor's representative makes all decisions involving permissible choices or company policy relative to the current test which are not covered in the application for test. Before any tests are made the lubricating oil is drained from the crankcase and replaced with new oil selected by the distributor's representative from brands generally available in Victoria.

The fuel used is the lowest grade recommended by the manufacturer or distributor which is readily available in this State. For instance, if the application for test states that the tractor will operate on gasoline or kerosene, then kerosene will be used. The cost of fuels and lubricants used is the responsibility of the distributor, but no fees are charged for running the test. The distributor's representative is responsible for the running in operation and for permissible adjustments to valves, points, plugs or clutch.

BELT AND DRAWBAR TESTS

The testing engineer then takes charge of the tractor and it is belted to the cradle mounted dynamometer used in determining the belt horsepower. The top radiator tank is drilled to take an indicating thermometer, a fuel line is installed from the tractor fuel lines to the fuel-measuring equipment, and measurements are taken of both engine and dynamometer pulleys.

After uniform operating conditions are reached, this test, known as the 100 per cent. or rating maximum, is continued for two hours. The object is to check or establish belt horse-power ratings. At ten-minute intervals observation readings are made of engine belt pulley and brake speed, load on the dynamometer, temperature of water in top tank of radiator, air temperature at a point five feet in front of the centre of the radiator, and the amount in pounds of fuel used. Barometer readings are taken every hour. The water level in the radiator is measured at the beginning and end of the two-hour period.

The observed maximum horse-power as determined in this initial belt test having been established, the tractor is then submitted to tests at operating maximum belt power for one hour, rated load belt test for one hour, and varying load tests during which fuel consumption and other operating data are carefully recorded.

For drawbar testing a motor truck is specially fitted to supply the necessary load in pounds pull on the drawbar and a dynamometer is coupled between the tractor and truck being hauled. Other recording instruments are fitted within the cabin of the truck from which continuous observation readings are charted. From this chart, showing the pull in pounds, and stopwatch readings, showing the time of travel over a measured course, the drawbar horsepower developed is calculated.

Drawbar readings are made at maximum horsepower, operating maximum and rated load test. For general purposes the latter rated load test is the most important as it constitutes a continuous run on the load for a fixed period of time of ten hours.

The object of this test is to determine whether the tractor can pull its rated load continuously in the working gear nominated

by the manufacturer and to secure a record of fuel consumption on drawbar work under those conditions.

At the conclusion of the rated load drawbar test, the lubricating oil is drained and measured and the tractor is also weighed on a Government inspected weigh-bridge. The weight is recorded in the test report and includes observed weight plus the weight of the operator and fuel and water in the tanks. After the engine has been inspected for condition of wear and tear at the end of the tests, the engineer in charge releases the tractor to the distributor's representative.

Hydraulic draught truck unit with dynamometer coupled to determine drawbar load. Recording instruments are mounted in the cabin.

The tractor tests which are summarised, classified and compiled by the Victorian Department of Agriculture from the data obtained, will be published in this Journal at regular intervals and altered and amended as further official tests of later model tractors from all sources are completed and new records become available. The summary appears on pages 570-572 of this issue.

Due acknowledgment is made of data supplied by the Nebraska University. This has been altered, where necessary, to comply with Australian gallon measures.

MILDURA DISTRICT FIELD DAY—*(continued from page 566).*

Two sprays of E.6.0.5. at 0.05 per cent. give control equal to a standard oil spraying, but 0.01 per cent. E.6.0.5. was not as good as oil.

Tests with nylon sheets for fumigation indicated that this material loses gas concentration faster than duck under conditions of low humidity.

Examination of the fruit at harvest, showed a small difference in favor of the Nylon covered trees. For practical purposes however, the covers were of equal value in producing kill of scale.

An illustrated lecture was given by Mr. F. M. Read, M.Agr.Sc., Chief Inspector of Horticulture, during the afternoon session at Red Cliffs. Mr. Read dealt with his observations on Californian citrus culture, and discussed the trend of orchard cultivation in California where about 50,000 acres of citrus groves are not cultivated at all. Weeds are kept under control by spraying with kerosene with good effect on the penetration of irrigation water. With regard to irrigation methods, multi-furrow surface irrigation was standard practice.

Concern was felt at the slow decline of citrus which was reflected in the increasing proportion of small sizes, and investigations on soil fumigants and nutritional problems were aimed at solving this trouble. Of the trials with new citrus rootstocks the Cleopatra mandarin and Troyer citrange were showing most promise.

In scale control, most Californian citrus groves were sprayed with oil, and research on the insecticidal properties of oil was of great importance.

The subject matter of Mr. Read's address appears elsewhere in this issue under the title, "Citrus Growing in California".

SUMMARY OF OFFICIAL TRACTOR TESTS.

The following particulars have been obtained from reports of tractor tests conducted in Australia by the Aeronautical Laboratories, Commonwealth Department of Supply and Development, in conjunction with the Victorian Department of Agriculture and the Agricultural Engineering School of Melbourne University and, in U.S.A., by the University of Nebraska. The Australian tests were carried out at the Commonwealth Laboratories at Fishermen's Bend (Vic.) and State Research Farm at Werribee (Vic.) with fuels available to tractor users in Australia. "N" designates Nebraska, and "A" Australia. Rated horsepowers are 75 per cent. maximum drawbar horsepower and 85 per cent. of maximum belt horsepower. Gear indicated.

Abbreviations Indicator.—Std. (Standard); Crl. (Crawler); Tri. (Tricycle) Ath. (Author); R.P.M. (Revs. per minute); V. (Vertical Cylinders); H (Horizontal Cylinders); No. (Number); G.P.H. (Gallons per hour); M.P.H. (Miles per hour); N.A. (Not available).

Tractor.		Origin.	Test.	Weight.	Fuel.	R.P.M.	M.P.H.	Rated H.P		Maximum H.P.		Pounds Pull.		Cylinders.		Price.
Trade Name. Model Type. Standard, Tricycle, Crawler.		Place of Manufacture.	No. Authority Year.	As Tested. Pounds.	Kind. G.P.H. Imperial Gallons Rated Load.	Rated C'sft.	Work Gear No. Slip.	Drawbar.	Belt.	Drawbar Calc.	Belt Calc.	Rated Work Gear.	Calc. Max. Gear.	No. Arrgmt.	Bore. Stroke. Inches	Subject to Altn., June, 49. Approx. £
Small Tractors and Equivalent Horse Teams, Rated Load Drawbar under 13 H.P., Suitable to Replace 2 to 5 Animal Horse Teams.																
Allis Chalmers	B Std.	U.S.A.	302 N 38	2,620	Distillate 0·90	1,400	4·0 2 G.	10·16	13·86	13·54	16·31	1074 2 G.	1473 2 G.	4 Cyl. V	3¼ 3½	362
Allis Chalmers	C Tri.	U.S.A.	363 N 40	3,205	Distillate 1·12	1,500	3·75 2 G.	12·57	17·17	16·76	20·20	1407 2 G.	1878 2 G.	4 Cyl. V	3⅜ 3½	390
Farmall Cub	..	U.S.A.	386 N 47	2,701	Gas 0·66	1,600	3·12 2 G.	6·67	8·30	8·89	9·76	837 2 G.	1063 2 G.	4 Cyl. V	2⅝ 2¾	N.A.
Farmall ..	A Std.	U.S.A.	330 N 39	3,570	Distillate 1·025	1,400	3·63 2 G.	11·65	14·55	15·53	17·12	1211 2 G.	1648 2 G.	4 Cyl. V	3 4	588
Oliver ..	60 Tri.	U.S.A.	375 N 41	4,040	Gas* 1·12	1,500	4·37 3 G.	13·39	16·58	17·85	19·51	1179 3 G.	1490 3 G.	4 Cyl. V	3 3½	N.A.
Newman ..	— Tri.	Eng.	7 A 49	2,744	Dieselene 0·42	1,840	2·93 2 G.	4·8	6·4	6·4	7·5	640 2 G.	860 2 G.	1 Cyl. V	3·35 3·94	555
Normag ..	..	Germ'y.	Not yet tested			..	..	..	..	..	..	..	..	..	..	N.A.
Medium-class Tractors and Equivalent Horse Teams, Rated Load Drawbar 14 H.P. to 19 H.P., Suitable to Replace 5 to 7 Animal Horse Teams.																
Allis Chalmers	WC Tri.	U.S.A.	303 N 38	4,545	Dist. 1·66	1,300	4·75 3 G.	17·27	22·98	20·41	27·03	1439 3 G.	1644 3 G.	4 V	4 4	725
							Replaced by Model WD.									
Case ..	S.C Tri.	U.S.A.	367 N 41	5,400	Dist. 1·49	1,550	3·50 2 G.	15·82	20·16	21·09	23·72	1794 2 G.	2177 2 G.	4 V	3½ 4	N.A.
John Deere	B Tri.	U.S.A.	381 N 47	4,996	Dist. 1·38	1,250	3·50 3 G.	16·64	20·68	22·19	24·33	1908 3 G.	2467 3 G.	2 H	4 5½	N.A.
Ferguson ..	TEA 20 Std.	Eng.	5 A 49	3,899	Petrol 1·68	2,000	4·62 2 G.	15·00	18·6	19·5	21·6	1320 2 G.	1650 2 G.	4 V	3·15 3·63	583
Farmall ..	H Tri.	U.S.A.	334 N 39	5,550	Dist. 1·40	1,650	3·50 2 G.	16·99	20·69	22·65	24·34	1968 2 G.	2484 2 G.	4 V	3⅜ 4¼	667
McCorm Deering	W 4 Std.	U.S.A.	342 N 40	5,690	Dist. 1·45	1,650	3·25 2 G.	16·87	21·14	22·49	24·87	2004 2 G.	2573 2 G.	4 V	3⅜ 4¼	704

Massey Harris	30 Std.	U.S.A.	Not tested	..	Kerosene*	1,500	Claims	15·50	23·35	To be tested shortly in Aus.				4 V	3 4⅜	675
Twin City ..	ZTU Tri.	U.S.A.	352 N 40	5,025	Gas 73* 2·06	1,500	4·70 4 G.	20·98	27·97	27·97	32·88	1748 4 G.	2258 4 G.	4 V	3⅝ 4½	658
Oliver ..	70 Std.	U.S.A.	284 N 37	3,500	Distillate 2·04	1,500	4·33 3 G.	15·87	23·89	21·16	28·11	1230 3 G.	1535 3 G.	6 V	3⅛ 4⅜	785
David Brown	VAK/1C Std.	Eng.	8 A 49	5,096	Kerosene 2·05	2,000	4·00 2 G.	17·0	21·9	22·7	25·7	1850 2 G.	2450 2 G.	4 V	3½ 4	820
Intermediate Tractors and Equivalent Horse Teams, Rated Load Drawbar 20 H.P. to 30 H.P., Suitable to Replace 7 to 11 Animal Horse Teams.																
John Deere	AR Std.	U.S.A.	378 N 41	6,350	Distillate 1·78	975	4·00 3 G.	20·35	26·30	27·13	30·98	1861 3 G.	2417 3 G.	2 H	5½ 6¼	834
John Deere	D Std.	U.S.A.	350 N 40	8,125	Distillate 2·92	900	4·00 2 G.	30·46	38·11	40·61	44·83	2907 2 G.	3641 2 G.	2 H	6¾ 7	991
John Deere	G Tri.	U.S.A.	383 N 47	7,442	Distillate 2·40	975	4·50 3 G.	27·01	33·83	36·01	39·80	2313 3 G.	2985 3 G.	2 H	6⅛ 7	994
Fordson Major	4·3 Std.	Eng.	2 A 46	6,776	Kerosene 2·00	1,200	3·80 2 G.	21·5	28·0	29·0	32·5	2500 2 G.	2800 2 G.	4 V	4⅛ 5	608
Fordson Half Tk.	4·3 Crl.	Eng.	33 A 49	7,600	Kerosene 2·10	1,200	2·50 2 G.	18·2	28·0	24·3	32·5	3000 2 G.	4000 2 G.	4 V	4⅛ 5	N.A.
Fordson Diesel	P 6 Std.	Eng.	44 A 49	7,532	DSL. Dist. 1·79	1,500	3·75 2 G.	28·0	35·0	37·5	41·0	3000 2 G.	4000 2 G.	6 V	3½ 5	1,046
Fordson Dsl. H.T.	P6 Crl.	Eng.	4 A 49	7,672	DSL. Dist. 1·73	1,500	3·15 2 G.	25·0	35·0	33·0	41·0	3150 2 G.	4200 2 G.	6 V	3½ 5	1,295
Farmall	M Tri.	U.S.A.	327 N 39	6,770	Distillate 2·31	1,450	3·50 2 G.	24·65	31·20	32·86	36·70	2941 2 G.	3653 2 G.	4 V	3⅞ 5¼	752
Farmall ..	MD Tri.	U.S.A.	368 N 48	7,570	Diesel 1·64	1,450	3·50 2 G.	24·78	31·08	33·04	36·56	2893 2 G.	3566 2 G.	4 V	3⅞ 5¼	N.A.
Itnl. WT. ..	T6 Crl.	U.S.A.	346 N 40	7,680	Distillate 2·20	1,450	2·20 2 G.	24·69	33·12	31·63	36·68	4266 2 G.	5400 2 G.	4 V	3⅞ 5¼	1,300
Itnl. WT. ..	TD6 Crl.	U.S.A.	345 N 40	7,950	Diesel 1·52	1,450	2·20 2 G.	22·12	30·80	29·49	34·54	3818 2 G.	4929 2 G.	4 V	3⅞ 5¼	1,400
McCorm Deering	W6 Std.	U.S.A.	354 N 40	7,744	Distillate 1·99	1,450	3·13 2 G.	24·60	31·19	32·80	36·69	3149 2 G.	3963 2 G.	4 V	3⅞ 5¼	801
McCorm Deering	WD6 Std.	U.S.A.	356 N 40	7,995	Diesel 1·48	1,450	3·13 2 G.	23·54	30·92	31·37	36·38	2948 2 G.	3997 2 G.	4 V	3⅞ 5¼	N.A.
Fowler Marshall	VF Crl.	Eng.	6 A 49	9,400	Diesel 1·71	750	2·92 4 G.	21·2	30·6	28·2	36·0	2740 4 G.	3650 4 G.	1 H	6½ 9	1,885
Massey Harris	44	U.S.A.	389 N 47	6,925	Gas* 2·56	1,350	4·98 3 G.	31·02	39·98	41·36	47·04	2472 3 G.	3197 3 G.	4 V	3⅞ 5¼	768
Twin City ..	UTS Std.	U.S.A.	311 N 38	7,940	Distillate 2·23	1,275	4·70 3 G.	24·54	31·54	33·29	36·48	2018 3 G.	2781 3 G.	4 V	4½ 5	788
Twin City ..	UTU Tri.	U.S.A.	319 N 39	6,773	Gas* 2·52	1,275	4·05 3 G.	28·32	38·48	37·76	45·27	2620 3 G.	3582 3 G.	4 V	4¼ 5	770
Oliver ..	88 Std.	U.S.A.	391 N 48	7,804	Distillate	1,600	4·31 3 G.	28·92	38·22	38·56	44·96	2430 3 G.	3162 3 G.	6 V	3½ 4	965
Chamberlain	40K Std.	Aust.	1 A 49	8,940	Kerosene 2·75	1,200	3·1 4 G.	30·00	36·8	41·0	42·7	3970 4 G.	5300 4 G.	2 H	6⅛ 6¼	N.A.
Allis Chalmers	U Std.	U.S.A.	..	Not tested in Australia			..	..	..	..	..	..	..	..	..	909
Case ..	DEX Std.	U.S.A.	349 N 40	7,005	Distillate 1·83	1,200	7·00 2 G.	24·77	31·83	33·07	37·45	2465 2 G.	5091 2 G.	4 V	3⅞ 5½	734

* Not yet tested on Kerosene in Australia.

SUMMARY OF OFFICIAL TRACTOR TESTS—*continued.*

Tractor.		Origin.	Test.	Weight.	Fuel.	R.P.M.	M.P.H.	Rated H.P.		Maximum H.P.		Pounds Pull.		Cylinders.		Price.
Trade Name. Model Type. Standard, Tricycle, Crawler.		Place of Manufacture.	No. Authority Year.	As Tested.	Kind. G.P.H. Imperial Gallons Rated Load.	Rated C'sft.	Work Gear No. Slip.	Drawbar.	Belt.	Drawbar Calc.	Belt Calc.	Rated Work Gear.	Calc. Max. Gear.	No. arrgmt.	Bore. Stroke.	Subject to Altn., June, 49. Approx.
				lb.											Ins.	£
INTERMEDIATE TRACTORS AND EQUIVALENT HORSE TEAMS, RATED LOAD DRAWBAR 20 H.P. TO 30 H.P., SUITABLE TO REPLACE 7 TO 11 ANIMAL HORSE TEAMS.—*Continued.*																
Twin City ..	UDS	Eng.	9	8,512	Diesel	1,275	4·75	30·0	37·2	40·00	42·5	2600	3450	4	4·52	2,050
	Std.		A 49		2·00		3 G.					3 G.	3 G.	V	5·12	
LARGE TRACTORS AND EQUIVALENT HORSE TEAMS, RATED LOAD DRAWBAR 31 H.P. TO 40 H.P., SUITABLE TO REPLACE 11 TO 14 ANIMAL HORSE TEAMS.																
Case ..	LA	U.S.A.	..	Not tested in Australia			..	..	..	..	..	..	..	..	..	1,016
	Std.															
McCorm Deering	W9	U.S.A.	371	10,190	Distillate	1,500	4·38	33·44	41·65	44·59	49·00	3022	3832	4	4·4	1,213
	Std.		N 41		3·03		3 G.					3 G.	3 G.	V	5·5	
McCorm Deering	WD9	U.S.A.	370	10,260	Diesel	1,500	4·38	33·59	41·79	44·78	49·17	3073	3852	4	4·4	N.A.
	Std.		N 41		2·22		3 G.					3 G.	3 G.	V	5·5	
Intnl. WT. ..	T9	U.S.A.	372	10,830	Gas*	1,400	2·25	32·24	41·39	42·98	48·69	5677	7091	4	4·4	N.A.
	Crl.		N 41		2·96		2 G.					2 G.	2 G.	V	5·5	
Intnl. WT. ..	TD9	U.S.A.	344	10,955	Diesel	1,400	2·20	29·16	39·02	38·88	45·91	4971	6637	4	4·4	1,925
	Crl.		N 40		1·97		2 G.					2 G.	2 G.	V	5·5	
Massey ..	55	U.S.A.	394	9,685	Gas*	1,350	5·22	40·65	52·18	54·20	61·39	3101	4028	4	4½	1,059
	Std.		N 48		3·40		3 G.					3 G.	3 G.	V	6	
Twin City ..	GTA	U.S.A.	317	9,445	Gas	1,075	3·8	36·27	48·93	48·36	57·56	3849	4964	4	4⅝	1,020
(Replaced by G.T.B. Model)	Std.		N 39		3·27		2 G.					2 G.	2 G.	V	6	
HEAVY DUTY TRACTORS, RATED LOAD DRAWBAR 41 H.P. UPWARDS, HEAVY DUTY EARTHWORK AND BULLDOZING.																
Allis Chalmers	HD-7W	U.S.A.	360	14,175	Diesel	1,500	2·55	45·08	60·42	60·10	71·08	6753	8570	3	4¼	2,999
	Crl.		N 40		3·34		2 G.					2 G.	2 G.	V	5	
Allis Chalmers	HD-10W	U.S.A.	361	21,630	Diesel	1,600	2·06	64·97	86·38	86·63	101·62	12159	15507	4	4¼	3,842
	Crl.		N 40		4·70		2 G.					2 G.	2 G.	V	5	
Allis Chalmers	HD-14	..	362	28,750	Diesel	1,500	2·18	99·14	127·98	126·98	145·39	17568	22699	6	4¼	N.A.
	Crl.		N 40		6·58		2 G.					2 G.	2 G.	V	5	
Caterpillar ..	D6	U.S.A.	374	17,750	Diesel	1,400	2·30	49·93	68·51	66·57	80·60	8510	10747	6	4¼	3,120
	Crl.		N 41		3·33		2 G.					2 G.	2 G.	V	5	
Caterpillar ..	D7	U.S.A.	358	24,790	Diesel	1,000	2·20	60·33	78·91	88·44	92·84	10335	13454	4	5¼	4,170
	Crl.		N 40		3·95		2 G.					2 G.	2 G.	V	8	
Caterpillar ..	D8	U.S.A.	357	35,000	Diesel	950	2·17	84·86	111·35	113·14	131·00	14728	19537	6	5¼	5,425
	Crl.		N 40		5·45		2 G.					2 G.	2 G.	V	8	
International	TD18	U.S.A.	315	23,360	Diesel	1,200	2·50	52·94	71·96	70·59	84·66	7943	10561	6	4¾	3,890
	Crl.		N 49		3·52		3 G.					2 G.	3 G.	V	6½	
International	TD14	U.S.A.	343	17,595	Diesel	1,350	2·50	40·53	54·42	54·04	64·02	6178	7919	4	4¾	3,030
	Crl.		N 40		2·58		3 G.					3 G.	3 G.	V	6½	

* *Not yet tested on Kerosene in Australia.*

Garden Notes for January

By George Hyam, Horticultural Supervisor

THE FLOWER GARDEN

Winter-flowering Annuals should be Sown Now

MOST flower gardens present a rather dull appearance during the winter, yet, with the exception of the colder, higher districts, there are numbers of annual bedding flowers which will give colour to the garden and supply some cut-flowers right through the winter months.

This lack of colour in winter is generally due to gardeners delaying the sowing of winter annuals until the summer flowers are finishing, or perhaps from the fact that sowing in the height of the summer heat seems to be difficult.

The main essential to ensure winter blooms from any of the so-called winter annuals is that these plants should have reached the flowering stage before May when short days and cool weather slow up or stop further growth.

All true winter-flowering annuals at maturity may be considered to be resistant to the relatively light frosts we experience in most parts of this State, but some of them can be killed or damaged by frost when young.

To obtain winter flowers, their seeds should not be sown not later than January, and the seedlings planted out in March.

Protection from direct heat is necessary for germinating flower seeds sown in January and after the pricking or thinning-out stage, hardening-off by gradually reducing the shade is most desirable so as to have acclimatised plants which will stand the hot, but not usually severe conditions, when they are planted out in March. The seedling frame illustrated and described in last month's issue will provide both conditions.

The seed of many of the winter annuals—Iceland poppies, primulas, pansies, cinerarias, ranunculus, and anenomes—are small and are best sown in boxes first, even if they are pricked-out in the open ground under the frame later. The larger seeds of stocks, wallflower, annual lupins, and sweet peas could be safely sown in seed beds under the frame, and after thinning, grown on there to planting-out size. Gardens not provided with a frame for protection can raise any of these species with rather more handling, by sowing in boxes; then pricking them out into seedling boxes, keeping these under varying degrees of shade provided successively by say, a verandah, the lee of a fence or building facing south, and finally, under the lighter shelter of a tree or shrub, which will protect them from the overhead midday sun and scorching north and west winds while still allowing some sunlight to reach them. A week or two before planting out, the boxes should be in the open except on the severest days.

Selecting Subjects for Winter Display

Some thought should be given to the species selected for winter flowers in relation to the position and aspect. The closely-allied species, stocks and wallflowers, can always be relied upon to provide colour in winter if the proper varieties are sown this month. Both these plants need a high lime or calcium content in the soil and an open sunny situation. Their seeds should be sown in very light soil, and, if sown in boxes, the soil should be at least 4 inches in depth. Of the several varieties of stocks, the early-flowering Nice or Giant Imperial strains are the most reliable winter-flowering kinds; other types are best sown later for spring flowering. The Early Parisian or Early Wonder wallflowers can likewise be relied upon to flower well in winter when sown now, but most of the other annual wallflowers should be sown early in December, to ensure winter flowers. If sown in January, there would be a chance of obtaining late-winter flowers and a certainty that they will flower in early spring if aspect and locality are favorable.

Cinerarias should be sown in January for flowering in June. These are about the only frost tender subjects in our list of usual winter annuals and should be planted so that they do not face the early-morning sun. They will do best under some top shade provided by shrubs. Cinerarias are easily damaged by heavy wind.

While winter-flowering sweet peas will grow to flowering stage in most parts of the State, except in districts with a heavy winter rainfall which might cause mildew, their flower buds are easily damaged by frost just as they are about to burst. This can be overcome by providing a hessian cover arranged on the top of the trellis to be drawn over if frost threatens at that stage. In any case, the main sowing of sweet peas is best deferred till the March-June sowing, as the spring flowering of this plant is the most prolific, except in the northern areas where excellent winter sweet peas are grown.

Primula malacoides sown now will produce an abundance of bloom throughout winter and spring. They can be planted in the open or in partial shade, and they associate well as a border to cinerarias or Iceland poppies. They will continue to flower until late spring if not too exposed.

Iceland poppies, pansies, violas, and antirrhinums should all be planted where they can get the maximum amount of sun during the winter. All of these are more effective when planted in massed beds. With the exception of antirrhinums, they need an enriched soil with a few applications of liquid manure in autumn to hurry them on to maturity.

Some winter-flowering annuals can well be sown direct; if necessary between growing plants of summer annuals. Sowing of these should be deferred to the end of January or to February. Calendulas sown in this way will make a bright winter show.

Mignonette which is always sown direct and preferably with some light overhead protection, produces best results when flowering in the winter and early spring.

The annual Pink Pearl and Blue Gem lupins sown direct in open beds will provide a background for the lower-growing winter annuals and they are hardy to all but the severest frosts.

Ranunculus and Anenomes from Seed

As quantities of these flowers are needed to give a good display, raising them from seed is an economical way to start building up a stock of them. Seed sown in early January will flower at the normal time in August–September, and from these, a selection of desirable colours can be made to provide corms for future planting. The seed of both should be sown on the surface of light soil in boxes with a very light covering of soil, and these should be placed under shade as both species are very tender when germinating. Under a frame, they can be sown in a seed bed and thinned to 1 inch apart; then allowed to grow on to planting size which they reach early in March. If sown later than January, they will rarely flower the first season.

THE VEGETABLE GARDEN

Winter Vegetables for Various Zones

January is the latest month when seed can be sown to ensure supplies of leaf vegetables during the winter months. In the southern zone, seedlings of Succession cabbage can be planted out, and Eastham cabbage sown in the seed bed. The former will be ready for use in April–May; the latter in June or July if they are kept well watered during the hot weather.

In Zone 2 and Zone 3, January is the best time to sow Succession cabbage and they, too, should be ready in early June if irrigated.

For all districts, January is the latest month in which Brussels sprouts can be sown to ensure a full crop, as any planting of sprouts ceases to produce any quantity in early August. Seedlings of Brussels sprouts planted out in January will produce from May to August and are consequently very economical of space in relation to the amount of pickings they will produce off a small area. About eight to ten plants are ample for an average family. In the two northerly zones (2 and 3) it is not advisable to attempt to grow sprouts as they are inclined to "blow", i.e., to produce open-leaved sprouts, where the winter and spring day temperatures are relatively high, but they might be grown on the central and north-east high country.

In all districts, green sprouting broccoli sown in January, February, or March will do well, and next to Brussels sprouts, will produce far more pickings than a similar number of cabbages and cauliflowers. Monthly successional sowings of these will supply green broccoli until late spring. About eight plants will be sufficient for one planting. In the southern zone (1), Phenomenal cauliflowers can now be sown and the seedlings of the earliest cauliflowers, such as Green Leaf, can be planted out. Early January is the time to sow Green Leaf in Zone 2, and here, Phenomenal could be sown in late January and February. In the north-west zone (3), it is best to defer sowing cauliflower until February and then sow the Phenomenal variety.

The State of Victoria divided into the three main vegetable planting zones.

It is still possible to sow carrots, parsnips, and beetroot in the south (Zone 2), and main sowings of these do well when sown in January in Zone 2. Autumn is soon enough to sow in Zone 3.

In all but the high-elevation districts, it is possible to grow an autumn crop of potatoes if these are planted early in January, using advanced seed sets obtained from early crops lifted in late spring. These, however, must be watered well during dry weather. This planting should be small as in many cases the potatoes will not reach full maturity before the frosts come, and consequently, will not store for long, but they will produce good "new" potatoes in autumn.

In cool districts, January is a good month to sow swedes; in other districts, defer sowing them until next month. Celery and leek seedlings can be planted out in January in Zones 1 and 2, and, in Zone 1, a further sowing of leeks can be made for late planting.

Other January Work

Tomatoes are fruiting in most districts, and the plants should now receive more frequent waterings and occasional applications of liquid manure or side dressings of sulphate of ammonia. The early fruits should be harvested when nicely coloured but before they are fully ripe, as maturing fruit on the plants is inclined to delay later trusses. The first fruits of pumpkins and marrows are better harvested for present use rather than allow them to reach full maturity. The later fruits also have a longer storage life.

Early January is not too late to make a final planting of late varieties of tomato seedlings and in the warmer districts, most vine vegetables could still be planted, though their yield will be lighter than that of earlier plantings. Final sowings of French and butter beans should be made before the end of January in Zones 1 and 2, and an early January sowing of sweet corn will come to maturity in all districts.

As each summer crop finishes, the bed should be dug over and well manured with organic manure prior to March planting if it is to be re-planted with winter leaf-crops. In garden crop rotation, leaf crops should follow peas or beans.

Home gardeners who tried out salsify for the first time, following notes given in this Journal last season, are reminded that January is a good month to sow this rather slow-growing "vegetable oyster". The seed is sown in drills like other root crops about ¾-inch deep and the plants are thinned out to a spacing of 4 inches.

Summer-sown " Odourless " Onions

Although it is not the season for sowing " odourless " onions to reach maturity for storing, some commercial growers make small sowings of this variety to produce green, semi-matured, bunched onions for sale during the late autumn. This can be recommended to home gardeners who have not grown many late long-storage onions. The thinnings and semi-matured onions can be also used for salads. This variety grows rapidly in summer but must be kept well watered during the early stages of growth.

Red Pickling Cabbage

Those who like variety in their vegetable diet will find that a somewhat different yet attractive flavour can be had by growing a few heads of red cabbage for cooking purposes, apart from their more usual use for pickling. The seed is sown now, and general cultivation is the same as for green cabbage. The Red Niggerhead or Red Drumhead are two good varieties not too coarse in texture for table use if not allowed to become overmature. Red cabbage is only suitable for growing in southern areas under climatic conditions favorable for Brussels sprouts.

FARM TRAINING FOR EX-SERVICEMEN

Short Courses at Dookie

The short courses in Principles of Farming and Farm Management at Dookie Agricultural College have proved to be so popular and of such benefit to trainees under the War Service Land Settlement Scheme that eligibility to attend the course has been extended to ex-servicemen who work their own farms or who have reasonable expectations of becoming farm owners irrespective of whether or not they have been classified as suitable for War Service Land Settlement.

Any ex-serviceman who has served in the 1939–45 war and who comes within these categories may now apply to the Deputy Co-ordinator of Rural Training to attend one of these courses. If accepted, he will be required to pay 25s. per week for board, lodging, and laundry. Only those ex-servicemen who have been classified as suitable for War Service Land Settlement and have applied for the course through the Soldier Settlement Commission will be paid living allowances.

Each course is of eight weeks' duration. Thus, for an outlay of £10, plus travelling expenses to and from the course, ex-servicemen under this extension of eligibility can obtain a course which not merely provides a thorough grounding in farm management and farm book-keeping but tuition in the fundamental principles of plant and animal production, climate and soils in relation to agriculture, soil conservation, dairying and pig raising, sheep and cattle husbandry, poultry rearing, crops and pastures, horticulture, and building construction. Modern farm machinery and tractors are demonstrated. Field demonstrations and excursions to stud farms and research stations are organized.

Five courses will be held in 1950, commencing on the 17th January, 23rd March, 6th June, 15th August, and 24th October, respectively.

Application forms for the course may be obtained from the Deputy Co-ordinator of Rural Training, Department of Agriculture, 605 Flinders-street, Melbourne, C.3.

CORRECTION

In a footnote to the article Fat Lamb Investigations, Rutherglen Research Station, column 1, page 483, of our November issue, " Wheat Board " should read " Meat Board ".